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Marxism and Ecology

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List of Abbreviations of Marx's Works

Quotations from Marx's own writings are given by title of work. Quotations from other authors are given by year of publication and page.

CW	<i>Marx, Engels: Collected Works</i> (London: Lawrence & Wishart, 1975–)
<i>Grundrisse</i>	<i>Grundrisse der Kritik der politischen Ökonomie</i> (Berlin: Dietz, 1953; Engl. translation Harmondsworth: Penguin, 1973)
<i>Manuscripts 1861–3</i>	<i>Zur Kritik der Politischen Ökonomie: Manuskript 1861–63</i> , in MEGA II
MEGA II	<i>Marx–Engels Gesamtausgabe</i> , part II (Berlin: Dietz, 1976–)
MEW	<i>Marx, Engels: Werke</i> , 42 vols. (Berlin: Dietz); supplementary volume I (1974)
<i>Paris Manuscripts</i>	<i>Economic and Philosophic Manuscripts</i> (1844), in CW III
<i>1859 Preface</i>	Preface to <i>A Contribution to the Critique of Political Economy</i> (1859), in CW XXIX
SW	<i>Selected Works</i> , 3 vols. (Moscow: Progress, 1975)
TSV	<i>Theories of Surplus Value</i> , 3 vols. (London: Lawrence & Wishart, 1972)

Introduction

Some fifteen years ago, Hans Magnus Enzensberger rightly remarked that the time when ecology confined itself within the limits of biology was over. During the last decades the term has undergone a change in meaning. When Haeckel coined it in the 1870s, it denoted that branch of biology which deals with the relations of living organisms to their surroundings. According to the *Oxford English Dictionary*, it is now also used in a broader meaning 'with reference to ecological issues such as industrial pollution considered in a political context'. Today it is the centre of bitter controversies within a discourse which draws on such different branches of sciences as biochemistry, biology, oceanography, mineralogy, meteorology, genetics, physiology, medicine, demography, statistics, thermodynamics, cybernetics, game theory, and so on (Enzensberger 1974: 4). It oscillates between the claim to become a new super-science and its (partly) pseudo-scientific manifestations. Ecology is also a social and political movement which struggles for environmental protection (the career of 'green parties' is a clear expression of this); and it is the name for a general attitude towards nature. It affects politics, industrial production, city planning, law making, education—there is virtually no part of modern life which has not been submitted to ecological reasoning or criticism. Throughout this book I shall use 'ecology' in this broader sense.¹

It seems to be commonly accepted that Marxism has little to say about ecological problems, that its implicit positions are far from illuminating them, and, what is more, that the Marxist position enables, causes, or legitimizes harm to the environment. At best Marxism is seen to be caught in the dilemma of rejecting the 'idiocy of rural life' and at the same time embracing the 'naturalization of man' and the 'resurrection of nature'. The present work is a thorough reconsideration of any such

¹ Ecology is also used in systems theory to denote the relations between systems and their environment. This meaning will be neglected here.

assumption. It tries to avoid simplistic answers. Instead, it tries to find out which sort of problems can be analysed by Marx's theory and which of its approaches are still convincing—a task which necessitates the reconstruction of his thought. In effect, this presupposes that I think there is something which can be exploited and reconstructed.

Among the many ideas which have shaped the debate about ecological problems in recent years, the issues connected to the notion of 'mastery over nature' or 'domination of nature' have been of great importance. A unifying element among ecologists is the belief that the Promethean project of mankind and modern attitudes towards nature are the ultimate causes of ecological problems. From this assumption they proceed to a rejection of the modern attitude towards nature and tend to embrace an ecocentric outlook. In their view mankind's attempts to master nature have resulted above all in a destruction of the natural environment. However, this is a faulty understanding of what domination means. Once we realize that domination only makes sense with respect to aims and interests, it becomes clear that a concern for the natural environment is not only compatible with a Promethean view but follows inevitably from it. King Midas had the power to turn everything he touched into gold. However, such a power can hardly be included in a proper definition of domination. Rather than enhancing the interests of the power-holder, it undermines them. Powers which turn into an existential threat for the power-holder do not contribute to domination. The use of the concept of domination of nature, therefore, can be understood only as a synonym for conscious control over nature. A cybernetic feedback loop rather than a reckless exploiter would be the appropriate image. Anthropocentrism and mastery over nature, far from *causing* ecological problems, are the starting-points from which to address them.

To understand the meaning of the ecological discourse, it might be helpful to look back to world-views of the last century. A common world-view of the nineteenth century was that the growth of scientific knowledge, technological development, and economic activity, in a word, 'industrialism', was an inherently positive thing because it served human purposes. The twentieth century saw the results of this unbounded productivism; it became manifest that although mankind succeeded in gaining

more wealth, the natural environment became more and more debased, which in turn was detrimental to human well-being. With this observation, it took little to conclude that productivism was responsible for this unpleasant state of affairs (see, for example, Jonas 1984, preface). Since human beings prosper at the expense of nature, so goes the claim of many environmentalists, they do not take into account that this debased nature will not allow mankind to prosper or survive in a not-so-distant future.

The Marxist opposition to this argument was a defence of productivism and a rejection of capitalism. In other words: the technological dynamism of the modern epoch was welcomed, and only its capitalist form was made responsible for ecological disasters. But there are also writers, whether Marxist or not, who claim that Marxism is of little help in investigating ecological problems. Anthony Giddens, for example, writes that '[i]n Marx, nature appears above all as the medium of the realization of human social development. The universal history of man is traced through the progressive elaboration of the productive forces, maximised in capitalism . . . But Marx's concern with transforming the exploitative human social relations expressed in class systems does not extend to the exploitation of nature' (Giddens 1981: 59). Giddens concludes that this 'Promethean attitude' is indefensible in the twentieth century since 'the expansion of the productive forces can no longer be treated unproblematically as conducive to social progress' (ibid. 60). But Giddens confuses expansion of productive forces 'as such' with productive forces which are detrimental to the natural environment. This may be a mere verbal quarrel. However, it seems that, in his terminology, the expansion of productive forces leads inevitably to an 'exploitation of nature'. While I think that nothing is wrong with 'exploiting nature', there is certainly something wrong with nature transformations which lead to worse life-conditions of human beings. In other words, I think that the 'Promethean' attitude is not only defensible, but also superior to Giddens's suggestion that Marx should have extended his concern to exploitation of *nature*.

It is true that Marx welcomed the growth of productive forces and, what is more, praised even capitalism for developing the productive forces in a hitherto unknown way. Thus, at first

sight, industrialism for him was part of the historical tendency of the productive forces to develop—an indispensable condition for the advent of a communist society. This outline has been summarized by André Gorz in the following way:

Until recently most Marxists still thought of forces of production—in particular science and technology—as ideologically neutral, and they considered the development of these forces of production to be inherently positive. They usually held the view that as it matured capitalism was producing a material base on which socialism could be constructed, and it was thought that the more the forces of production developed under capitalism the easier it would be to build socialism. Such productive forces as technology, science, human skills and knowledge and abundant dead labour (fixed capital) were considered to be assets that would greatly facilitate the transition to socialism. (Gorz 1973: 159)

But Gorz does not share this view; on the contrary he thinks that modern science and technology are 'ideological' in the sense that they are shaped in decisive ways by capitalist interests. Indeed, there are several authors who deny that there can exist something like 'innocent' productive forces. As we shall see, this question is a crucial one for Marx's own analysis. This discussion will lead to the result that we must be aware of a double meaning of the term 'growth of productive forces': it can mean (1) increasing mastery over nature and (2) production of wealth (material goods) with ever-diminishing effort or in increasing abundance. The first meaning is that mankind gains an ever-greater mastery over nature, in the sense that individuals develop into universal human beings, that they *expand* their control over the world around them, that they are able to shape a world according to their needs and pleasures. Let us call this the 'broad meaning' of historical materialism (which, for the sake of brevity, I also refer to as the 'philosophical' meaning). The second meaning is primarily economic; a growth in this sense can be measured with economic criteria of efficiency. Let us call this the 'narrow (economic) meaning'.

Both meanings in Marx are linked together. The dignity of human beings requires freedom from hunger as much as it does freedom from a hostile nature which acts upon them as an alien force. For Marx two alternatives are thus excluded: first, to accept modern civilization in which detrimental effects stem

from man's transformation of nature, and, second, to go back to a state in which the well-being of people could not be secured on the material level. Marx's position was a plea to *expand* human power and control over one's life-conditions to such a degree that the release of all human powers would lead only to beneficial consequences.

A critique of Marx can only start at this point. If there is any basic flaw in his treatment of productive forces and the domination of nature it is in the insufficiently clear distinction between the growth of productive forces and increasing mastery over nature. Marx, at times, seems to assume that the former does imply the latter. Against this I argue that there may be productive forces which do *not* lead to an increasing mastery over nature but, rather, to an increasing uncertainty, risk, and uncontrollability as well as to unnecessary oppression in the production process. However, we may also find in Marx an implicit distinction between these two meanings if we look at his awareness of the shortcomings of a purely economic approach. This awareness leads him to a radical opposition to the Political Economists who thought that capitalist market economies would maximize economic efficiency and thus human welfare and happiness. His attack on Political Economy thus embraces both elements: it offers arguments against the efficiency claim as well as arguments against the maximization of human welfare and happiness, for capitalism is an irrational form of enhancing efficiency (crises!) and it *decreases* happiness. It only creates the material preconditions for a real human society. If this reasoning is true, Marx does not equate increases in economic efficiency with an increase of human mastery over nature.

But some critics of industrialism go one step further: they make the basic claim that the development of productive forces *per se* is incompatible with the prospering of nature. From this proposition they conclude that industrialism should be limited (or even abolished) in the interest of nature and mankind.

Although Marx rarely addressed ecological problems, this much is clear: he sharply opposed such pessimism. Instead of assuming the basic incompatibility of modern technology with the prospering of mankind he assumed—at least in *Capital*—only the basic incompatibility of modern technology *under capitalist relations* with the prospering of mankind. As my

analysis will show, this judgement by Marx does not stand up to the empirical evidence. The twentieth century has seen a rapid development of productive forces which has been partly enhanced by public enterprises or by socialist enterprises (i.e. enterprises in socialist countries). In both cases the damaging effects did *not* disappear (as we might expect on the basis of Marx's prediction). On the contrary, it seems that socialist countries present an even worse ecological record than capitalist countries.

Does this invalidate Marx's analysis? Are we to abandon his framework since the empirical facts have (once more) belied his predictions? My answer is no. One reason is that he analysed the implications of machine technology (above all in the recently published *Manuscripts 1861–3*) and was aware that the technological structure of capitalism—not only the capitalist use of it—may be detrimental for 'the good society'. Another reason is that Marx's *prediction*, based on the concepts of the critique of Political Economy, may have been falsified, but not necessarily other parts of his theory. If I say that Marx's framework is still illuminating this does not mean that it gives us a point of reference which is sufficient for the understanding of ecological problems. In investigating more deeply the philosophical argument, this work is also distinguished from some attempts at 'reconstructing' a 'green' Marx, a procedure which usually rests on a compilation of apparently 'green' statements by Marx (cf. Schmied-Kowarzik 1984). One of them is the famous passage from the *Paris Manuscripts* where Marx spoke of a 'humanization of nature and naturalizing of man', which is usually interpreted as the young Marx's desire to bring about harmony between man and nature. In my view, such *ad hoc* 'reconstructions' of an 'ecological Marx' do not reveal interesting insights. For we all know that Marx was no ecologist, even if he *could* have been one.

But still, the philosophical Marx may reveal fundamental and illuminating insights. Marx's theory, after all, aims at human emancipation. If we forget this, Marx was not much different from an economist who measures human wealth in terms of prices and per capita income. Marx's life work consisted mainly in showing that capitalist economy is a state of affairs in which individuals are systematically unable to control the outcomes of their actions. Such a critique highlights economic crises, but

also 'business as usual' and its reification of social relations. Crises, alienation, and fetishism affect *all* members of capitalist society, that is, capitalists, too, are caught in a situation 'unworthy of their human nature'. Post-war prosperity and interventionist techniques of the Welfare State in the economy have led many to believe that the basis for a socialist critique of capitalism has vanished. Yet many Marxists and Marxologists feel that the range of Marx's theory is not exhausted by the fact that capitalism has brought about considerable economic growth. The decisive reason why Marx's theoretical range is wider is because he stresses the need for humans to have control over their fate. This is to say that, even granted that capitalist economy works smoothly (which may still be doubted on good grounds), there may be other respects in which human control has not been established. Only if such a control is improbable, implausible, or even undesirable would we have reasons to oppose the underlying logic of his critique of capitalism.

If we turn away, then, from Marx's political economy, and enter his philosophical discourse, we encounter, first, the abstract relation between man and nature, as a transhistorical condition, and then the specific historical forms which this relation assumes. Technologies serve as criteria to distinguish such historic formations. Marx is equally concerned about people's ability to understand and control the world around them. As a writer of the nineteenth century he was rather optimistic as regards the possibilities of science and technology in this process. But again, although his expectations have not been fulfilled, one who is interested in human emancipation should not prematurely dismiss his theoretical outline. On the contrary, if science and technology have not been instruments for mankind to shape a world which is intelligible and controllable, we still live in conditions which have to be superseded in order to achieve human emancipation, a task in which Marx's theory may be of help. Whether or not this will yield valid or feasible solutions, it will articulate the ecological problems of industrial societies from his philosophical framework. This framework is a unique combination of various modern philosophies, such as Bacon's, Kant's, Hegel's, Feuerbach's, and others. In sharp contrast to this, the discourse of fundamentalist environmentalism proposes to industrial societies that they adopt 'a simpler life' in order to

safeguard the survival of this planet. If the ecological challenge is a challenge to basic assumptions of modern thinking, let us see; then, to what use one version of the modern view of nature, namely the theory of Karl Marx, can be put.

I will therefore start with the hypothesis that two of Marx's expectations have been disproved: the expectation that science and technology would create an intelligible and controllable world as well as the expectation that only capitalist relations stand in the way of such a goal (but equally wrong are those environmentalists who foolishly believe that the basic fault has to be seen in the attempt to harness nature to human purposes or to develop productive forces). I argue that *some* productive forces may run counter to the aim of extending human control over nature. This study therefore investigates the conditions under which modern technology is developed and applied (ch. 3). If the growth of the productive forces does not lead automatically to an increase in mastery over nature, we also have to reconsider basic assumptions of historical materialism (ch. 4). A reformulation of basic assumptions of historical materialism will inevitably affect our understanding of what communism is, or should be (ch. 5).

Alfred Schmidt in his pioneering study has already remarked that we have to collect many scattered remarks from a wide range of Marx's theory, since Marx never treated the concept of nature in a separate discussion. These scattered remarks, put together, open up a complex discourse, since its elements are interwoven in many ways. There are many possible connections with other elements of his theory or with the theories of others. This could take us to philosophy, natural sciences, history, epistemology, political economy, sociology, and further afield, where there is considerable danger in being distracted from the centrally important discussion. For this reason, I have largely excluded questions of epistemology, political economy, and history from this study, giving preference to an approach which locates Marx in a philosophical tradition and connects his thoughts to contemporary social theory and interpretations of his work.

The framework of this book is as follows. Chapter 1 surveys the most common approaches to ecological problems which attempt an understanding of both phenomena and causes of

ecological problems. It also provides some minimal conceptual standard on which later chapters will rely. For example, I shall provide a definition of what an ecological problem is and why this is a preferable definition to what is often heard. It is distinguished from loose talk like 'destruction of nature', 'ecological crisis', or 'ecological collapse'.

Chapter 2 tries to relate Marx's thought to the findings of Chapter 1 in a direct way (s. 2.1) and then reconstructs some possible approaches from within his body of thought (ss. 2.2 and 2.3). It will turn out that the concepts of nature and human nature, as developed by Marx, provide an excellent starting-point for the discussion (ss. 2.4 and 2.5). Marx's philosophical anthropology provides the conceptual framework within which an illuminating analysis of the ecological problematic can be undertaken. For it turns out that Marx conceives of a transhistorical situation of mankind in which it has always to transform nature in order to survive. This is a process which takes place within societies and by means of technology. Both, societies and technology, are in constant development. Marx conceptualizes this in a theoretical model which is commonly called historical materialism. This model contains an interest both in the evolution of societies and also in the evolution of technologies.

Chapter 3, therefore, focuses on the topic of technology and technological evolution. It confronts Marx's findings with those of post-Darwinian evolutionary theory, discusses the similarities and differences between science and technology, considers a systems theoretical analysis of technology, and addresses the question whether Marx was a technological determinist. Finally, some attention is dedicated to Marx's analysis of modern machine technology. Most interestingly, Marx conceived of the possibility that this technology may constitute a condition of alienation. However, there is a decisive difference between such suggestions (above all spelled out in the *Grundrisse* and the *Manuscripts 1861-3*) and his final pronouncements in *Capital* (see s. 3.5). This chapter thus provides some new findings as regards exegetical matters. But not only the analysis of machine technology has to be mentioned here. The division of labour is a topic on which much has been written without doing much justice to Marx. Section 3.6 will therefore clarify what Marx thought on this topic.

Chapter 4 links technological evolution with the evolution of social forms. My starting-point here is the 1859 *Preface* which I try to reconstruct in different terms from those of the base-superstructure model. I try to conceive of technology and society as developing together in a process of coevolution. Again, I try to use models provided by post-Darwinian evolutionary theory and by systems theory. The reader will also notice that I give another interpretation to the formula of 'fettering of the productive forces' which here is not interpreted along the lines of an orthodox reading which focuses on property relations. Instead, I take it in the broader sense that the development of the human race as such must not be thwarted (s. 4.5). It is argued that ecological problems can be illuminated using a historical materialist framework, if the dimension of Marx's philosophical anthropology is not neglected. If one interprets Marxism in terms of a narrow (economic) conception of the development of productive forces, it loses all of its critical impetus. For it is not the institution of private property which fetters the development of the productive forces in this (economic) sense; and it is not the institution of state planning which unfettered the development of the productive forces in this sense.

But likewise, the presence of ecological problems cannot simply be explained in a monocausal way, for instance that private property inevitably leads to ecological problems or that state planning leads to them (or helps to avoid them). This is to say that the present historical level of nature transformation (which takes place with certain technologies) makes ecological problems likely (from hidden to manifest, from chronic to catastrophic). It is far from clear that forms of property have a causal influence on this state of affairs.

Chapter 5 embarks on a discussion of the concept of communism, both as originally formulated by Marx and as seen by other authors. Central for the discussion is the notion of labour which contains an emancipatory dimension. I argue that the distinction between a realm of necessity and a realm of freedom is important for Marx and parallels a distinction made earlier (s. 2.4) between first and second nature. According to Marx, true freedom is only possible within second nature. Where the untransformed first nature presses man to work, this is not free activity, although it can in principle be done with pleasure and in the absence of

alienation. Marx coins the term *travail attractif* for such a realization of labour in communist society. My aim here is also to destroy the myth that the later Marx became more pessimistic as regards the possibilities of the *realm of freedom*. In my opinion he always held the view that nature-imposed activities cannot count as free activity, although they could in principle be done in non-alienated ways. Freedom, for Marx, can be gained only in human objectifications, in second nature. The more first nature is transformed into second nature, the more its laws are understood and the more mankind is able to free itself from its strains. Communism is the culmination of such a process. This is to say that only a society which is able to control its own workings on the natural environment is worth the name communist.

Chapter 5 also draws some attention to the question whether Marx was against or in favour of markets and central planning and whether he overlooked the problems which stem from scarcity, personal differences, and social complexity. Here it is argued that Marx faced a dilemma when addressing the problem of markets and plan—a dilemma which he was not able to solve. He was also ambiguous on the problem of scarcity; sometimes he thinks that abundance is unlikely to occur under communism. As regards social complexity, it seems that Marx took the simple epistemological standpoint that human creations are understandable by humans, that humans as creators and observers of their creations are able to discern them in an uncontested truthful way. This would be even easier if humans transformed first nature into second nature, thereby replacing nature more and more with culture. However, it escaped his attention that this process led to an increasing social complexity and made the conditions for social transparency vanish.

1 Establishing Phenomena, Claims, and Explanations

You want to *live* 'according to nature'? . . . To live—is that not precisely wanting to be other than this nature? Is living not valuating, preferring, being unjust, being limited, wanting to be different? (Friedrich Nietzsche, *Beyond Good and Evil*)

Nature builds no machines, no locomotives, railways, electric telegraphs, self-acting mules etc. These are products of human industry; natural material transformed into organs of the human will over nature. They are organs of the human brain, created by the human hand; the power of knowledge, objectified. (Karl Marx, *Grundrisse*)

Since the first studies concerning ecological problems appeared,¹ the topic has been an ever-present issue in many contemporary debates. These studies were alarmist in tone. They led to a debate which altered the political discourse in one important respect: the natural environment became an issue for political activity, for political parties and for governments. It became an issue for social and political sciences, for economics, moral philosophy, and law. Other parts of society increasingly realized that environmental questions were crucial; but just how crucial turned out to be a topic for many debates. These debates are still going on and partly taking place in the mass media. Their very logic seems to lead to a permanent switch of attention. The urge for novelty periodically discovers new ecological problems, from the ozone hole to the greenhouse effect, from noxious chemicals in food chains to smog in big cities. However, the fact that it is the mass media that disperse this news should be no reason for neglecting the underlying problems. Very often mass media reports are simply translating available scientific know-

¹ Carson 1962, Meadows *et al.* 1972. See the criticisms of Heilbrunner 1973, Myrdal 1973, and Galtung 1973 with respect to the latter.

ledge into commonsense language. This indicates that ecological problems are socially constructed.

1.1. Phenomena

It is worth noting that the 'early' reports on environmental problems were stressing the interconnection of several factors which would lead to an ecological crisis or collapse, the most important of them being exhaustion of resources, population growth, and pollution. At least in respect of the problem of resources and population, recent studies, such as the Commission of the United Nations on Environment and Development, are more optimistic.² The 1987 report of the commission lists the following phenomena:

1. pollution (air, water);
2. depletion of groundwater;
3. proliferation of toxic chemicals;
4. proliferation of hazardous waste;
5. erosion;
6. desertification;
7. acidification;
8. new chemicals (see United Nations 1987: 10)

In a quite illuminating but little-discussed book, Passmore listed the following problems:

9. pollution;
10. depletion of natural resources;
11. extinction of species;
12. destruction of wilderness;
13. population growth (cf. Passmore 1974: 43).

Since (1), (3), (4), (7), and (8) are contained in the more general (9), I shall take Passmore's list as the basis for further discussion. Since (11) and (12) are contained in (10), we have basically pollution, depletion of (renewable and non-renewable) resources,

² 'The commission believes that widespread poverty is no longer inevitable' (United Nations 1987: 8). 'Global agriculture has the potential to grow enough food for all, but food is often not available where it is needed' (ibid. 12). 'Hunger often arises from lack of purchasing power rather than lack of available food' (ibid. 13). Note that the depletion of natural resources does not figure as a separate theme in the report.

and population growth as ecological problems. Erosion and desertification fall out of the list. They are natural processes anyway and interesting in our context only in so far as they are caused by human intervention. In this case we might classify them under (10), distinguishing between renewable resources (agriculture) and non-renewable resources. Side-effects of chemical substances (such as pharmaceuticals) would have to be included under pollution. Population growth can be an ecological problem in two senses. First it can be seen as leading to ecological problems such as pollution or depletion of resources, because an increasing population might require more intense exploitation of resources or more technological development with pollution as a side-effect. Second, it can be seen as an ecological problem *per se*, that is, the increasing number in a specific place may be detrimental to human well-being. Taken in the first sense it is a cause of, taken in the second sense it is an instance of, an ecological problem.

The issue has a practical and a theoretical dimension. The practical dimension is that almost every country has been affected by ecological problems in a more or less significant way; it has become one of the central political questions in the course of a few years. In many countries social movements have come into being which have already made an impact on political, legal, scientific, and economic matters.

1.2. Ecological claims and approaches

Turning to the theoretical implications, I shall first devote some attention to looking at explanations of, and claims about, ecological problems. It is important to be precise here, since the way of defining and explaining the problem to a great extent determines the solution.

I start with the most basic and most radical thesis which is put forward by environmentalists and shared by many others. This is the claim that ecological problems are the consequence of a specific attitude towards nature which has prevailed in the Western world for some centuries. This attitude towards nature is called 'domination of nature' and considered to be false and undesirable. It follows as a corollary that, in order to overcome

ecological problems, the dominating attitude of man towards nature should be replaced by another. The roots of our, presumably false, instrumentalist view of nature are usually dated back to the Enlightenment (mechanistic world-view; separation of body and soul, of subject and object) or even to Judeo-Christian religion. This latter claim was made by Lynn White Jr. when he said that the biblical creation story was responsible for the growth of technology and the consequent destruction of large elements of nature (cf. White 1973; Norton 1987: 143): 'And God said, let us make man in our image, after our likeness; then let them have dominion over the fish of the sea and over the fowl of the air, and over the cattle, and over all the earth . . .' (Gen. 1: 26-9).

There are two lines in the ecological discourse regarding the strategy to overcome this false attitude towards nature. According to the first, mankind should retreat to a lower state of nature transformation and adopt a simpler way of life in order to restrict its interventions in natural processes;³ the other holds that such a way back is not open to us. As Amery put it, 'there is no way back to the ritual dance around the divine bear' (Amery. 1976: 197, my translation). When some authors ('New Age') speak of a social and cultural revolution which would be necessary to bring harmony to man's relationship to nature, this can be understood in both ways. But no matter how we judge the many different projects and Utopias in this discourse, they all share the basic claim that the dominating attitude of mankind lies at the root of the problem.

The basic thrust of this present work is to oppose such a claim directly. In my view 'domination of nature' is not responsible for ecological problems; quite the contrary: the very presence of ecological problems proves the absence of such a domination. In other words, it is still a reasonable approach with which we can make sense of the problem and stipulate solutions. Now, this seems to be such a bold contention that it might be discarded by many from the very beginning. Let me therefore proceed in more detail.

Confronted with the dramatic events of the twentieth century, the temptation has been strong for many thinkers to regard the

³ This view sometimes has an authoritarian flavour, especially in the version of Gruhl (1975) and Harich (1975).

heritage of Western civilization and Enlightenment very critically and even reject its 'project of rationality'. As, for example, Adorno and Horkheimer in their *Dialektik der Aufklärung* wrote:

The conservatives' conclusion, that horror and civilization are bound together, is well established . . . Only under the sign of the hangman did culture develop . . . under the sign of the hangman are labour and enjoyment. To contradict this would mean to make a mockery of science and logic. One cannot abolish the horror and retain civilization . . . But different conclusions can also be drawn from this: one has to scorn logic, if it is against mankind. (Adorno and Horkheimer 1981: 245, my translation)

In my view this position mistakenly identifies certain specific results of Western rationality with rationality as such. From this fallacy follows the rejection of Western-type rationality and the search for other world-views which promise to do better. Furthermore, this fallacy might suggest that another approach (mystical, religious, irrational) would avoid the problems in question; such a suggestion, however, could be quite dangerous for modern industrial societies. Utopian projects have to acknowledge the highly complex character of modern technology if they want to bring about feasible changes. Marcuse, posing himself this problem, thought that there could be two types of mastery over nature, a repressive one and a liberating one (see Marcuse 1964: 185). To this position Habermas quite rightly objected that

modern science can be interpreted as a historically unique project only if at least one alternative project is thinkable. And, in addition, an alternative New Science would have to include the definition of a New Technology. This is a sobering consideration because technology, if based at all on a project, can only be traced back to a 'project' of the human species as a whole, and not to one that could be historically surpassed. (Habermas 1971b: 87)

Analysing contemporary ecological thought, Oechsle found that a common world-view prevalent in it is naturalism. Naturalism, according to her, proceeds in the following way. It first juxtaposes nature and society and then tries to bring them together in such a way that society adapts its laws to the laws of nature. As she put it, naturalism here means the attempt to explain and under-

stand society on the basis of specific natural laws and to deduce social norms and principles of social organization from ecological principles (cf. Oechsle 1988: 9). Haeckel, the founding father of ecology as a scientific discipline, already claimed in the nineteenth century that man should lead his life in accordance with natural laws. It is intriguing to see that this naturalistic world-view is a common denominator of all political tendencies in the ecological discourse. We find it in conservative authors like Gruhl (1975: 33, 345); in communist-Stalinist authors like Harich (1975: 161); in anarchist writers like Bookchin (1977: 15), and in eco-socialist writers like Lalonde (1978: 53). All of them claim the authority of nature and her laws to be the foundation stone of a new society which will solve ecological problems. Gruhl and Harich are alike in that they stress the iron necessity with which nature operates; from this they derive similar tough political measures. Bookchin argues that spontaneity in life converges with spontaneity in nature (1977: 10), and Lalonde stresses the fact that nature is and society should be self-organizing. This short overview shows that nature is an authority which many think to be uncontested; however, as closer analysis shows, each version of nature is a construction of its author. Therefore, what the 'nature of nature' is, is a matter rather of debate than certainty.

This already makes clear that any discourse on nature and ecological problems is not without presuppositions; and these presuppositions lie within the cultural background of the participants of the discourse; they are a product of history. A definition of 'nature' or of ecological problems, therefore, always relates to an anthropocentric element. Since the reference point for evaluation is human, non-anthropocentric approaches of nature preservation, so I suggest, are defective. Oechsle rightly refuses ecological naturalism. However, she does not defend anthropocentrism in a straightforward way, as—in my opinion—she should have done. In my view, man's special position within nature is characterized by *his domination of nature*. In order to separate the question of whether mankind has a special status within nature from the question of whether mankind should dominate nature, Oechsle (approvingly) cites Mumford, who claimed that within occidental civilization there have been examples of a 'democratic' technology. This argument gives her

the possibility of defending a sort of anthropocentrism without embracing the notion of domination of nature. However, a distinction between a democratic and an authoritarian technology makes sense only with respect to man, not with respect to nature. Every technology, even the softest, forms a part of man's domination of nature. Oechsle comes close to acknowledging this when she writes that even the most 'dialogical' approaches towards nature (as, for example, proposed by Prigogine) cannot but lead to a more perfect domination of nature. Ludwig Trepl expressed this in the following way: 'An ecological technology means total grip. For this reason ecology does not stand outside the logic of progress, but the latter culminates in it' (Trepl 1983: 11, my translation). Oechsle agrees with authors like Amery, Bahro, and Meyer-Abich (*inter alia*) that we have to research the origins of destroying nature. These are seen in the specific occidental human self-understanding and world-view. As Amery put it:

If one does not expose the roots of these historical and ideal attitudes, the necessary remedies will always meet political and social resistance, and only if one realizes how deeply rooted these attitudes are in our collective underground, can the necessary, i.e. radical and most painful, process of a planetary revolution be initiated. (Amery 1976: 10, my translation)

But at the same time Oechsle defends the anthropocentric world-view to a certain degree. Man is *Natur und Übernatur*, is part of nature and at the same time 'above' or even 'outside' nature. Human beings have no fixed place where they have to live; virtually every place on this planet can be inhabited by them. By this they distinguish themselves from most other animals (and, of course, plants) who survive only within a limited geographical, biological, climatic zone. How are human beings able to survive in an 'insecure environment'? The answer is: by constructing a second 'nature' around them.⁴ This artificial, man-made nature is the embodiment of their need to fight against nature; it is the solution of the apparent paradox that they are in and against nature. The solution of the paradox entails a wholly new dimension by which human beings distin-

⁴ In comparison, an animal species in an unfavourable environment will undergo an evolutionary process in order to survive.

guish themselves from animals: it is the use of tools or technology. But something further follows from this. Because human beings are organizing their life in the described way, they have no 'natural enemies' as almost every other species has though, certainly, they sometimes have specific parts of nature in opposition to them, nature which exerts its resistance upon them. As John Stuart Mill observed, the powers of nature 'are often towards man in the position of enemies, from which he must wrest, by force and ingenuity, what little he can for his own use' (Mill 1904: 15).

This stresses again my objection to the ecological world-view which challenges the anthropocentric world-view. Nature, as such, is not always beneficial for human beings. It is completely mistaken to identify nature with 'good' and technology or human culture with 'bad'.⁵ Moralizing helps rarely, less so with respect to nature. As Passmore observed quite rightly, 'these natural processes may in fact be quite harmful, so that, let us say, oysters from granite regions ought to be condemned for human consumption. The "natural" is not necessarily harmless, let alone beneficial to man' (Passmore 1974: 47). In exactly the same vein, Adorno, reflecting on the landscape of the Swiss Alps, remarked:

Both, the scars of civilization and the untouched zone beyond the timber line, are contrary to the idea that nature is a cheering, warming thing, dedicated only to man; it reveals what the cosmos looks like. The usual *imago* of nature is limited, narrowly bourgeois, sensitive only to the tiny zone in which historically familiar life flourishes; the bridle path is cultural philosophy. (Adorno 1968: 327, my translation)

Passmore, in reply to Barry Commoner's 'Third law of ecology—nature knows best', pointed out:

It is true enough . . . that every human intervention in an ecosystem is likely to disturb the workings of that system in a way that is detrimental to some number of it. So much is true of every change, man-induced or nature-induced. But it by no means follows, as his 'law' might seem to suggest, that every such change, or even most such changes, will be detrimental to human beings. Unlike the watches to which he compares

⁵ As Kluge has shown in a detailed study, much of the ecological rhetoric consists of the juxtaposition of *life and death*—where nature stands for the former, industrialism for the latter (see Kluge 1985).

them, ecological systems were not designed for man's use. When men picked seeds off plants and sowed them on cleared ground, they acted in a way that was detrimental to the organic life which was accustomed to feed on the fallen seeds. But only the most unreconstructed primitivist would suggest that the actions of our agricultural forefathers were destructive of human interests. A nature left entirely alone as 'knowing best' would support only the dreariest and most monotonous of lives. (Passmore 1974: 185)

The anthropocentric approach has the main virtue of offering a reference point from which to evaluate ecological problems. The reference point, as we shall see, can be defined in different ways (currently living human individuals, society, mankind, future generations) but, no matter how we define it, it establishes a clear criterion of how to judge existing ecological phenomena. Any 'eco-centric' approach, on the other hand, is bound to be inconsistent, unless it adopts a mystical standpoint. It is inconsistent because it pretends to define ecological problems purely from the standpoint of nature. It starts with assumptions about nature and natural laws to which all human action should adapt.⁶ But it is evident that the definition of nature and an ecological balance is a *human* act, a human definition which sets an ecological balance in relation to *man's* needs, pleasures, and desires.⁷ Consider now the following claims:⁸

Ecological problems are the result of man's domination (C1) of nature.

Following from this, another model of man's relation to nature would eliminate ecological problems. The alternative model

⁶ Note that the refusal of anthropocentrism is followed by a conspicuous position which anthropomorphizes nature, i.e. it projects human standards and inventions into the working of nature. But why should nature work in a 'balanced' manner? Or why should nature always be beautiful? Is it not man who introduces laws of beauty into nature? Cf. Dante: 'And therefore we need not praise man for his physical beauty which he gets by birth since it was not he who made it. Instead, we should praise the maker, that is, human nature which produces so much beauty in its material when it is not restricted by it' (*Convivio*, III, iv. 8), and Marx in the *Paris Manuscripts*, 'man forms objects in accordance with the laws of beauty' (CW iii. 277).

⁷ From a systems theoretical viewpoint, this claim can be put in the following way: 'society is a communicatively closed system and cannot communicate with the environment. It finds no one there to answer. And even if this were the case it would then be included within society' (Luhmann 1984a: 549, my trans.).

⁸ Cf. for the following also Bühl 1981.

would be communicative instead of dominating. 'Harmony', 'conviviality', and 'co-operation' would be the underlying principles (cf. Bloch 1986; Illich 1973). This claim having already been criticized above, let us turn to the next one:

Ecological problems are basically the result of man's (C2) destruction of nature.

This definition releases us from the difficulty of alternative modes of conceiving and treating nature. (C2) does not necessarily refuse the domination of nature; it only opposes some extremely negative features ('destruction'). However, this claim is equally misleading since it suggests the (false) belief that nature could be destroyed (by human action or otherwise). This definition leads us immediately to metaphysical arguments and to the idealism-materialism opposition. Interestingly enough, many of the participants of the ecological debate are 'materialists' (virtually all natural scientists) and therefore should not believe in the possibility of nature's self-destruction, and, in fact, most of them would not subscribe to such a position, although many ecologists make use of this definition. Scientists, quite explicitly, refer to the 'second law of thermodynamics' (entropy law) to express their preoccupation in this respect (see Georgescu-Roegen 1971, 1980).

But there remains another sense in which (C2) is understood. In this version the destruction of nature is not taken in the sense of physics but in an evaluative sense. 'Destruction of nature' here refers to the disruption of the environment human beings live in. This version is usually implied in the following claim:

Ecological problems result from man's short-sighted (C3) exploitation of nature.

A 'short-sighted' exploitation of nature can have two different meanings: (a) nature's intrinsic values are violated; (b) negative repercussions from exploited nature to man are not taken into account. As I shall explain below, only (b) can be used in a meaningful way.

The ecological discourse, however, does not usually speak of ecological problems, but of *ecological crisis*. The notion of crisis derives from medicine and has been widely applied, above all to economy. It denotes the turning-point of a pathological state (for example fever in medicine, depreciation of capital in

economy). The notion of crisis thus introduces a dramatic dimension into the ecological discourse: it suggests that nature is undergoing an 'abnormal' development which has to culminate in a crisis which then gives way to a new, 'normal' state. But each crisis can also lead to the opposite result: in this case the 'infected' system (organism) will not recover but die.

From this last alternative we get the following prediction:

Current ecological crises lead necessarily to ecological (C4) catastrophes (and eventually to the final collapse).

It goes without saying that much of the dramatic dimension of the ecological discourse rests on this element. To subscribe to this claim a clear analysis of the present situation and a reliable prognosis of the immediate future of the planet earth would be required. The following two examples may illustrate this. The first example is the problem of CO₂ emissions into the atmosphere. One position holds that this process will lead to the 'greenhouse effect', that the planet's atmosphere will be heated up with consequences like change in global weather or the melting of polar ice and the consequent flooding of many big maritime cities. The counter-position holds that increasing emissions of dust will cause a counter-tendency which prevents the heating up and thus prevents the greenhouse effect (cf. Miller and Miller 1989).

The second example is the question of scarcity of natural resources. Again, scientists have expressed considerable disagreement; a judgement in this case depends on the answer to the question of how fast technological progress will be (in order to find substitutes for scarce resources). Thus I think that many of the 'alarmist' statements are the expression of one tendency within a variety of competing claims.⁹ For this reason I shall abandon the catastrophic prediction, but also the following claim:

Ecological problems are only temporary and not very (C5) severe; they will soon vanish.

which is the symmetrical counter-argument to (C4).

⁹ In saying this I do not deny the existence of ecological catastrophes (in the sense of Perrow's 'normal accidents', below). What I deny is the logical status of these catastrophes in the above definition. There, they have the status of an instance for a 'final crisis'.

Passmore proposed the following, very broad definition: A problem is 'ecological' if it arises as a practical consequence of man's dealings with nature (see Passmore 1974: 43). Since this definition avoids the problems of (C1) to (C5), and has the virtue of relating clearly to human action, I shall adopt it as the basis for further discussion—with one additional qualification: 'practical consequences' means that man's dealings with nature retroact upon society in a way which is detrimental to human well-being. This definition takes into consideration the fact that nature by itself can also induce ecological problems. This is the case with floods, eruption of volcanos, fall of meteorites, etc. The important point here is that we are obviously interested in ecological problems which are produced by society and the solutions of which lie within the scope of social action.

Man's dealings with nature are generally characterized by the following properties. First, man is part of nature, he is living in nature; biology defines him as the most highly developed mammal. Nature, however, is the realm of competition for survival. Thus human beings have to secure their position in nature as do other animals. But human beings distinguish themselves from other animals in their own particular way of maintaining life.

If we characterize human beings as living in and dominating nature, this does not present two statements which are incompatible with each other. When we say that a problem is ecological when it arises as a consequence of man's dealings with nature, many might agree. But I think it useful to push the point a bit further. It does not mean that the very fact of dealing with nature (manipulation, domination, harnessing, or seduction) is the crucial point, the 'cause', so to speak, of ecological problems. Ecological problems arise only out of *specific* ways of dealing with nature. To repeat my claim from above: both man's existence in nature and his attempt to dominate nature are compatible; human beings live in, and dominate, nature.

Out of a misunderstanding of this relation, both ecologists and their declared enemies conclude the mutually exclusive character of the two predicates. Both positions are wrong in that they identify the problem of dominating nature as the heart of the matter. Consider the following argument which takes the eco-centric approach to extremes, thereby demonstrating its absurdity. Recall (C4) from above. There we saw that a 'pathological' state

was distinguished from a 'normal' state of nature. But it is difficult to know what is 'normal' for nature. Ecologists will probably argue that the 'normal' state of nature is a balanced state of nature. Since I cannot see how this definition can work without reference to human interests and definitions, I claim that nature is always in 'balance with itself'. Take the example of a river in which, as a result of pollution (detergents), no fish survive. But instead of fish other animals and plants (e.g. algae) are flourishing. The ecologist, confronted with such an argument, would probably say that if the river cannot return to the former ('normal') state with its own powers, its ecosystem would have to be called 'unbalanced'. But in so arguing, she would only reveal her preference for higher living organisms. Usually lower animals such as insects and bacteria are outside the concern of ecological reasoning. Albert Schweitzer tried to be consistent and defended the right of living for the tsetse fly and the tubercle. This position, radical in ethical and religious respects, makes a consistent course of human action impossible. Consider the case of the AIDS virus!

Let us take the argument a step further and consider the example of a river which is drying out. In this case again we have 'nature': sand, rocks, plants, insects, reptiles, mammals. The ecologist would now probably reply that nature's diversity and complexity has been destroyed. And here, ironically, we have the resurrection (if only implicit) of the anthropocentric view, namely that it is man who has an interest in conserving natural complexity. Now an adherent to the ecocentric view could argue that nature 'for itself' should be complex. But unless one adopts a mystical or religious standpoint, there is always a human interest behind the attitude that nature should be left out there 'for itself'. The reasons behind such a human interest are either of an aesthetic or a purely selfish character or spring from man's general care about his environment. Take the example of pollution. Mary Douglas provided the following insight into the problem. She claims that 'uncleanness is matter out of place' (Douglas 1966: 40). What makes a place wrong is dependent on the cultural value system of a given society. With respect to Western societies we may say that it might be wrong aesthetically, that it is detrimental for health, or that it destroys wildlife, plants, and animals (cf. also Passmore 1974: 45-6). If we do not

conceive of the 'selfish' character in a narrow, economic, short-term way, all criteria can be reduced to this category.¹⁰ My suspicion is that the ecological discourse shaped its arguments in a counter-position to economics, and also took over a basic flaw of that theory: the identification of short-term rationality (as expressed in economic behaviour) with rationality as such. Out of this identification it is only logical to refuse an anthropocentric approach as a guiding line in solving ecological problems. Human beings are seen as inherently short-sighted; it follows that their needs must not count as criteria for ecological politics. Doing away with this confusion, the anthropocentric standpoint makes perfectly possible a concern about the 'flourishing of nature'; it is by no means bound to be an accomplice to the tendencies which cause ecological problems. Yet, what is more, I claim that this standpoint is the only one which can consistently speak in terms like 'flourishing nature' and the only one which lays its standard of critique open, thus facilitating analyses and solutions for these problems.

As Norton aptly observed, environmentalists often make two typical confusions. The first is the belief that one must choose between attributing intrinsic and instrumental value to an object, that no object can be valued for its intrinsic value and simultaneously for its usefulness. The second is the belief that one must either attribute intrinsic value to an object or else leave it without any protection from the vagaries of human consumptive demands. Such beliefs sometimes lead to the confusion that protection of nature on anthropocentric assumptions is a contradiction in terms. As regards the first belief, Norton rightly contends that 'one can assign instrumental value to an object without automatically denying that it has value beyond that usefulness . . . Attributing intrinsic value to an object limits the ways in which that object can be used but need not prohibit all use of it' (Norton 1987: 219). As regards the second belief, Norton shows that it is wrong as well. A simple thought can make this clear: 'One need not attribute intrinsic

¹⁰ Consider the case of a domestic animal which falls ill and would die without medical care. Its 'natural' destiny would be to die. But, if the owner of the animal so wants, he tries to get it cured. This attempt need not be attributing intrinsic value to the animal because he may try to cure it on purely selfish grounds, i.e. simply because he would feel bad if the animal died without his effort to prevent it from dying.

value to a neighbour's property in order to have a good reason not to destroy it. Nor need one attribute intrinsic value to nature in order to have good reason not to use it destructively' (Norton 1987: 219). Interestingly, from this instrumental view of nature we can derive a rationale for the protection of species which is again anthropocentric. One might believe that humans who protect rather than destroy other living things are less likely to be violent in their dealings with other humans. One should, therefore, value wild birds, for example, 'as providing occasions for the uplifting of human attitudes and values' (ibid. 221).

One cannot escape the cultural value system of contemporary Western societies when criticizing it. This is to say that ecological fundamentalists are bound to participate in rational debates, to presuppose rationality standards, etc. As Krohn put it: 'The critique of science must take the form of science, in order to be effective' (Krohn 1983: 128, my translation).¹¹ The results of an 'ecologically inspired' research (for example, the emerging discipline of ecosystems research) may thus, again ironically, contribute to a better domination of nature. As van den Daele (1987) has shown, ecology does not mean the transition to a non-technological or to a purely contemplative concept of nature, but to a better technological concept. The Baconian vision of domination of nature is thus not abandoned but perfected (cf. van den Daele 1987: 414).

Since the mechanism of man's dealings with nature does not provide any barrier for a more perfect domination of nature, such a barrier—if one wants to have one—must be established by humans. The ecologists do establish such a barrier in *remoralizing nature and science*, thus challenging the famous claim of Bacon who once formulated that it is an error to believe that 'the inquisition of nature is in any part interdicted or forbidden' (Bacon 1986: 20).¹² In his view nature is 'a granary and storehouse of matters, not meant to be pleasant to stay or

¹¹ Thus a member of the German Green Party, Maren-Griesebach, wrote: 'Ecology as basis for action, for politics. Since it is a scientific basis and can be proven with certainty . . . no one can avoid it' (1981: 32, my trans.).

¹² Cf. also Kant in the preface to the 2nd edition of *Kritik der reinen Vernunft*: 'Reason must approach nature with the view, indeed, of receiving information from it, not, however, in the character of a pupil, who listens to all that his master chooses to tell him, but in that of a judge, who compels the witnesses to reply to those questions which he himself thinks fit to propose' (Kant 1952a: 6).

live in, but only to be entered as occasion requires, when anything is wanted for the work of the *Interpreter* . . .' (ibid. 255, original emphasis).¹³

1.3. Causes of ecological problems

In section 1.2 I have sketched some essential human features in their relation to nature. From this we can infer the abstract possibility of ecological problems, for it is always possible that man acts upon nature in a way which causes changes in nature detrimental to his own life.

In what follows I present several approaches which have been applied to investigate ecological problems or which can be used for this purpose. We may divide them into economic and sociological ways of looking at the problem. The latter will be presented in sections 1.3.2 and 1.3.3, the former in sections 1.3.4–1.3.7. Generally we may distinguish between two completely different mechanisms which are at work, which 'cause' ecological problems, so to speak. The first conceives ecological problems as a result of purely intentional behaviour, whereas the second conceives them as essentially by-products of human action, as unintended in character. The first mechanism can be expressed in the economists' approach of 'externalities' which are the result of the strategy of an entrepreneur to externalize his costs as far as possible. The second mechanism has been studied above all by philosophers and has been taken up by social scientists.¹⁴

In determining what counts as 'intended' and 'unintended' the time horizon which is presupposed is crucial. Not by chance do the economists disregard long-term consequences of economic behaviour; they are transformed into 'social costs'. Likewise, although the producers and consumers of certain potentially damaging products may be aware of the inherent danger, they nevertheless decide to produce and use (consume) them. But at the same time they make their calculations about future

¹³ Marx shared this position, as we shall see in ch. 2.

¹⁴ To be sure, the two are ideal types which may not exist in this pure form. A firm which externalizes may not be aware of causing a specific type of ecological damage.

developments. Some think that the consequences of their behaviour will not react upon them, or will occur only in a distant future; others think that they will not be alive to witness the catastrophic results (*après moi le déluge*); still others think that no catastrophes will take place in the future because of the beneficial technical innovations which reduce or abolish the dangerous potential of these products, or likewise reduce or abolish already manifest pathological symptoms.

The unintended character of human action stresses the limits to human design. It is thus more pessimistic regarding the possibilities for abolishing ecological problems. Even if it were the case that entrepreneurs were not externalizing costs, but were ecologically aware, even if it were the case that no dangerous products are produced deliberately, there may be damages to the environment (if only in the long run). The two mechanisms are intertwined if we consider long time-spans and take human experience into account. Here the actors know that their actions may have detrimental effects on the environment, but they 'take the risk', the more so the more the consequences of that action will show up only in a distant future. Ecological problems are thus no 'information problems' in the first place. Even if people are well informed about the inherent dangers of some products/actions etc. they are not likely to stop. This mixed form of unintended/intended mechanism is thus present in sections 1.3.3–1.3.7. I start out with a discussion of technology which seems to be the decisive precondition for modern ecological problems—but which should not be confused with a *cause* of them.

1.3.1. Technology

Above, I said that ecological problems arise from man's dealings with nature. In modern societies these dealings take place on an industrial level, and are carried out by technological means. We may generally distinguish two possible types of ecological problems: (1) ecological problems arising out of the 'normal' working of technology; (2) ecological problems arising out of accidents or catastrophes. Instances of (1) are, among many others, acid rain or toxic substances in food chains. Instances of (2) are accidents like Three Mile Island, Chernobyl, Seveso, or

Bhopal. While I turn my attention to (1) throughout the remainder of this section, I shall consider (2) in section 1.3.3.

The report of the United Nations commission attributes a prominent place to technology. It says: 'Emerging technologies offer the promise of higher productivity, increased efficiency, and decreased pollution, but many bring risks of new toxic chemicals and wastes and of major accidents of a type and scale beyond present coping mechanisms' (United Nations 1987: 16). Commoner expressed a similar view: 'In modern industrial societies, the most important link between society and the ecosystem on which it depends is technology. There is considerable evidence that many of the new technologies which now dominate production in an advanced country such as the United States are in conflict with the ecosystem. They therefore degrade the environment' (Commoner 1971: 178–9).

A simple consideration makes clear that technology stands at the heart of the matter. Mankind in its early stages, with primitive technology, could not affect its environment in the same way as mankind can today: the axe and fire could not, even under conditions of most careless use, cause dangers which were in the least comparable to present dangers which arise out of the use of nuclear or chemical technology. The difference, then, lies mainly in the greater scope and greater complexity of modern technology in comparison to old technology. Greater scope means that a single malfunctioning of modern technology may affect regions and people far away from the event; it may affect a larger number of people and for a longer time span. Greater complexity means that modern technology is a composite of many parts which are embedded to a large degree in an institutional framework; social institutions and technology permeate each other. Both are complex in their nature, thus 'increasing complexity. This leads to an ever-decreasing degree of transparency (see s. 5.5.).

This makes it very difficult to determine more precisely 'causes' for ecological problems. It follows that the solution of ecological problems is equally difficult to achieve. If a chemical factory puts hazardous waste on a field, we can identify the cause and its solution immediately. As Luhmann (1989c) pointed out, in such cases an adapted police law would suffice. But in most cases things are not so easy. As Passmore has put it, 'the

solution of an ecological problem will normally depend on the . . . solution of a sub-set of problems—scientific, technological, economic, moral, political, administrative—each with its own style of solution' (Passmore 1974: 46).

Thus interdisciplinary research is required to render possible a scientific understanding of ecological problems. There has been a considerable boom in the last few years in ecological literature which does consider itself 'interdisciplinary'. Even the term 'super-science' has been coined for ecology, but a big part of it must be characterized as dilettante.¹⁵ This is because the subject-matter is so complex that no existing single discipline of science (let alone a single person) can make competent analyses.¹⁶ The emerging 'ecosystems research' and the institutionalizing of 'technological assessment' (see McBrierty 1988; Smits and Leyten 1988; Tuiniga 1988) are steps in the direction of a truer interdisciplinary dimension.

1.3.2. *Unintended consequences*

Suppose now that scientific research has yielded results and we are able to understand the working of a particular ecological problem. What comes next is (at least in many cases) the development of a new technology, a technology which reduces or eradicates the undesired outcome of the old technology.¹⁷ Paradoxically, here we may enter a vicious circle, because the production or operation of the new technology may also produce ecological problems. As Passmore said: 'Any technological innovation . . . involves an element of ecological risk; it is impossible to calculate all its consequences in every possible circumstance' (Passmore 1974: 49).¹⁸

¹⁵ As Enzensberger observed, 'today everyone counts as expert in ecological matters' (Enzensberger 1973: 2, my trans.).

¹⁶ To be sure, many biologists have tried to develop solutions for the social, political, economic, or legal sphere, but they did not seem to be very appealing to their addressees.

¹⁷ I do not consider here such simple cases as the 'adapted police law' or any other 'simple new law' which is able to abolish any existing ecological problem in one blow.

¹⁸ Cf. also Perrow: 'It is particularly important to evaluate technological fixes in the systems that we cannot or will not do without. Fixes, including safety devices, sometimes create new accidents, and quite often merely allow those in charge to run the system faster, or in worse weather, or with bigger explosives. Some technical fixes are excuses for poor organisation or an attempt to compensate for poor system design' (Perrow 1984: 11).

Modern technology thus exhibits a feature of social life in general: human actions and intentions are crossed, mixed, and annihilated by unintended consequences. Merton distinguishes between unintended consequences and unanticipated consequences and makes clear that 'undesired effects are not always undesirable effects' (Merton 1937: 895). From this it follows that undesired unanticipated consequences can be equated with unintended consequences (in the sense I use the term). Note that Merton in his later 'Manifest and Latent Functions' defines three types of unintended consequences (see Merton 1968: 105): functional, dysfunctional, and irrelevant consequences. Ecological problems resulting from unintended consequences are thus clearly dysfunctional in character; but, as we must ask, dysfunctional in regard to what? Dysfunctional consequences may appear for parts of the economic system (for example: rise in prices for raw materials), the health system (increase in diseases), the political system (overburdening with legitimization). Additionally, the political system cannot regulate the problems by law in a simple way, but may instead trigger off a vicious circle by its very intervention. While I shall come back to this point in Chapter 2, let me briefly summarize Merton's view. He first limits a correct anticipation of consequences of action to an existing state of *knowledge*. Especially in situations which demand immediate action of some sort, the probability is high that we do not act on the basis of scientific knowledge but on opinion and estimate. As Merton himself put it:

Moreover, even when immediate action is not exacted, there is the *economic* problem of distributing our fundamental resources, time and energy. Time and energy are scarce means and economic behavior is concerned with the rational allocation of these means among alternative wants, only one of which is the anticipation of consequences of action. In our present economic order, it is manifestly uneconomic behavior to concern ourselves with attempts to obtain knowledge for predicting the outcomes of action to such an extent that we have practically no time or energy for other pursuits. (Merton 1937: 900)

The second factor is error. This means that actors often assume that 'actions which have in the past led to the desired outcome will continue to do so' (ibid. 901). The third factor is what has been called 'imperious immediacy of interest' and refers to

instances 'where the actor's paramount concern with the foreseen immediate consequences excludes the consideration of further or other consequences of the same act' (Merton 1937: 901). Merton further explains that the action may be rational 'in the sense that it is an action which may be expected to lead to the attainment of the specific goal; irrational, in the sense that it may defeat the pursuit or attainment of other values which are not, at the moment, paramount but which nonetheless form an integral part of the individual's scale of values' (ibid. 902). This, however, is not only a question of conflicting values, but of short-term and long-term rationalities. Ecological problems seen in this way would suggest an identification of the paramount interest with the immediate economic benefits; other values (for example, environment) are suppressed and become a long-term concern. A similar but distinct factor concerns the basic values involved in the course of human action: 'activities oriented toward certain values release processes which so react as to change the very scale of values which precipitated them' (ibid. 903). Instances of this are self-defeating processes like the rise of the Protestant ethic which in the end brought about wealth and abundance. Viewing ecological and economic values in this perspective, one may say that the result of the dominating economic value in Western societies has been to contribute to the emergence of its 'antagonist': the (fundamentalist) defenders of ecological values who express their paramount concern with immediate ecological goals, no matter what the result for the economy.

The fourth and last factor Merton mentions is the intriguing fact that successful social prediction and planning are often hampered by public predictions of future social developments 'precisely because the prediction has become a new element in the concrete situation, thus tending to change the initial course of developments' (ibid. 903-4). Applying this last model again to ecological problems, we may for once receive a more optimistic picture: we might expect that the apocalyptic tone of the first world reports on environment have already changed the course of development, leading to a decline in pollution and a slower depletion of resources. But if we consider Merton's third factor, where a basic value becomes self-defeating, then we may get a much more pessimistic picture: then, the reduction in ecological

damage results in the decline of ecological awareness thus allowing a new (vicious) cycle.

As we have seen, the feature of unintended consequences makes social planning difficult.¹⁹ This is basically due to the fact that we cannot predict the character of these consequences: they may be inherently beneficial or harmful (to all of mankind or to parts of it, in respect of short-term or long-term considerations). Broadly speaking, we can summarize Merton's typology into two classes: unintended consequences as resulting from imperfect knowledge ('error' being part of it) or as resulting from the actor's paramount concern with immediate results. In section 1.3.3 the knowledge aspect plays a crucial role but is also mixed with the second aspect, whereas in sections 1.3.6 and 1.3.8 the 'imperious immediacy of interest' will be centrally important.

1.3.3. *Industrial accidents*

I now come to the second possibility (above): industrial accidents. Up to now we have arrived at the possibility that some industries, during their 'normal' working, pollute, that is, produce toxic or otherwise dangerous waste. Now I shall consider the possibility that some industries (irrespective of whether working 'cleanly' or not) are likely to produce accidents which set free toxic or otherwise dangerous substances.

Charles Perrow has studied high-risk technologies and their institutional setting, combining the study of organizations with the study of technology. His analysis thus contains two elements: technology (see s. 1.3.1) and unintended consequences (see s. 1.3.2). As Perrow pointed out, some characteristics of high-risk technologies 'suggest that no matter how effective conventional safety devices are, there is a form of accident that is inevitable' (Perrow 1984: 3). This alarming conclusion is derived from the specific features of modern technology: '[M]ost high-risk systems have some special characteristics, beyond their toxic or explosive or genetic dangers, that make accidents in them inevitable, even "normal"'. This has to do with the way

¹⁹ As Passmore said: 'this is not a very encouraging line of reasoning . . . [b]ut it is at least realistic, firmly based on human history . . . that the unintended consequences of men's actions are more important, for the most part, than the consequences they intend' (Passmore 1974: 83-4).

failures can interact and the way the system is tied together' (Perrow 1984: 4). This sort of system is characterized by 'interactive complexity' and 'tight coupling'. Perrow employs two variables in his analysis: linear/complex systems and loose/tight coupling. Linear processes and loose coupling are less prone to system accidents. But note that even 'the most linear of all systems will have at least one source of complex interactions, the environment, since it impinges upon many parts or units in the system' (ibid. 75). 'Loosely coupled systems, whether for good or ill, can incorporate shocks and failures and pressures for change without destabilisation. Tightly coupled systems will respond more quickly to these perturbations, but the response may be disastrous. Both types of systems have their virtues and their vices' (ibid. 92). If the above two variables taken together inevitably produce an accident, this would be the case for a *normal* or *systems accident* in Perrow's definition. As he makes clear, 'we have such accidents because we have built an industrial society that has some parts, like industrial plants or military adventures, that have highly interactive and tightly coupled units. Unfortunately, some of these have high potential for catastrophic accidents' (ibid. 8).

A well-known and widespread view blames the operators for causing accidents. Perrow, however, shows that 'the operator is confronted by unexpected and usually mysterious interactions among failures'. Saying 'that he or she should have zigged instead of zagged is possible only after the fact. Before the accident no one could know what was going on and what should have been done' (ibid. 9). It is complexity and tight coupling which has to be seen as cause for a 'normal accident'. These two features make it possible that small and trivial beginnings often cause great events. 'Where chemical reactions, high temperature and pressure, or air, vapor, or water turbulence is involved, we cannot see what is going on or even, at times, understand the principles. In many transformation systems we know what works, but sometimes do not know why. These systems are particularly vulnerable to small failures that "propagate" unexpectedly, because of complexity and tight coupling' (ibid. 10).

Perrow's approach must not be confused with the so-called 'Murphy's Law' (i.e. that everything that can go wrong will go

wrong). As Perrow himself put it: 'The legendary Murphy was wrong. His law, that if anything can go wrong it will, is disproved by almost all post-accident investigations of large disasters. These investigations repeatedly point out that "it was lucky it wasn't worse"' (ibid. 111). Not all systems, however, display the characteristics outlined above. Systems which are not very complex, and are not coupled tightly, can still have accidents, as all systems can. 'But they are more likely to stem from major failures whose dynamics are obvious, rather than the trivial ones that are hidden from understanding' (ibid. 10). It is worth noting that on the basis of Perrow's analysis the process of specialization alone does not lead to a loss of control over technology or to detrimental effects of technology on the natural environment or on human well-being. But such is exactly Tiezzi's claim: 'It is said that technologies must to a large degree be scientific since one of the fundamental parameters in the productive system today is complexity. But this leads to an increase in specialization and consequently to a loss of control and of knowledge of (complex) reality, no matter whether on the part of the people or on the part of specialists. The more specialization we have, the less we are able to foresee the effects of technology upon nature' (Tiezzi 1984: 35, my translation). This is a somewhat exaggerated view since the problem is not whether technologies can (or should) be controlled by everybody. In this respect every specialization erects a barrier to such 'egalitarian' claims. The problem is rather that complex technologies may *not even* be controllable by specialists (cf. also Shrader-Frechette 1984: 114).

In conclusion, we might say, then, that there exists something which is likely to produce catastrophic accidents: the high-risk systems. Perrow investigated the following technologies: nuclear energy, petrochemical plants, shipping, air traffic, genetic engineering, space missions, dams, mining, and weapon systems. The result is that the most catastrophic potential resides in nuclear weapons and nuclear power; hence they should be abandoned. Marine transport and DNA recombination have only little less catastrophic potential, hence they should be restricted. The last category is chemical, mining, airways, space, and dams which, according to Perrow, should be tolerated and improved (see Perrow 1984: ch. 9). Perrow summarizes the implications of his

analysis in the following way: 'On the whole, we have complex systems because we don't know how to produce the output through linear systems. If these complex systems also have catastrophic potential then we had better consider alternative ways of getting the product, or abandoning the product entirely' (Perrow 1984: 89).

Summarizing sections 1.3.1 to 1.3.3 we may state that modern industry's potential for causing ecological problems is considerable. To forestall another point of this chapter it must be said that few of the outlined characteristics of high-risk systems can be deduced from the institution of private property.

1.3.4. *Economic growth*

A further candidate for causing ecological problems is industrial growth. The explanation is straightforward. Low levels of industrial production produce low levels of output hence low degrees of waste and possible pollutants. High levels of industrial production produce high levels of output hence high levels of waste and possible pollutants.²⁰ Regarding the input side, we can establish a similar link: low levels of industrial growth require low amounts of natural resources, high levels of production require high amounts of resources (regarding both energy supply and raw materials). It is commonly agreed that the period since the Second World War has been a period of exceptionally rapid economic growth which has caused a considerable amount of hitherto unknown ecological problems. But even if we had declining or low levels of industrial production, ecological problems would be likely to survive, given the characteristics of modern technology. As Barry Commoner put it: "Economic growth" is a popular whipping boy in certain ecological circles. As indicated earlier, there are good theoretical grounds why economic growth can lead to pollution . . . However, this theoretical relationship does not mean that any increase in economic activity automatically means more pollution. What happens to the environment depends on how the growth is achieved' (Commoner 1971: 141). He emphasizes the impact of new technologies which have been used in the US economy

²⁰ Some fundamentalist ecologists, such as the German Carl Amery, thus demanded that production should stop where possible (cf. Amery 1978: 167).

since the Second World War, insisting on the point that 'the post-war technological transformation of the United States economy has produced not only the much-heralded 126 per cent rise in GNP, but also, at a rate about ten times faster than the growth of GNP, the rising levels of environmental pollution' (ibid. 146).

Beckerman, in a straightforward way, defended economic growth in the following terms: 'For even if there were no growth, and even if national product were declining, there would still be a danger, in the absence of appropriate policies, that pollution would be excessive and that insufficient resources would be devoted to the preservation of the environment' (Beckerman 1974: 105). This is so because pollution reflects a failure of the market rather than being a result of economic growth (cf. ibid.). Thus, if people 'think that growth must be stopped or slowed down on account of excessive pollution' (ibid. 18), they are completely mistaken. Pollution has nothing to do with growth but is a question of *misallocation* of resources (cf. ibid. 35, 104).

In the following discussion I concentrate on approaches which all in one way or another have to do with economic rationality, market behaviour, or 'Western' rationality as such. I start with the sort of economic behaviour which is characterized by burdensome costs to the public ('externalities') and consider then a game-theoretic formalization. The difficult question then arises as to whether this economic behaviour is typical for market economies (such as capitalism) or if it is a more general pattern which would also apply to post-capitalist societies. Since we find empirical evidence for the latter assumption, we must try to explain it.

1.3.5. *Market, externalities, and the tragedy of the commons*

Pigou, over fifty years ago, drew attention to the following feature of economic behaviour: '[S]moke in large towns inflicts a heavy uncharged loss on the community, in injury to buildings and vegetables, expenses for washing clothes and cleaning rooms, expenses for the provision of extra artificial light, and in many other ways' (Pigou 1932: 184). This leads to the tendency of private capital to externalize costs. As Passmore points out, the owner of a factory calculates 'that he will only have to meet

such costs as directly arise from his particular enterprise, such costs as raw materials, labour, machinery, depreciation, taxation, insurance. He does not expect to meet the cost of replacing Mrs Jones' curtains, even if it is the smoke from his factory that causes them to rot' (Passmore 1974: 65).

Neo-classical economics would argue that the market principle leads to beneficial outcomes in this respect provided that a system of property rights is established which includes natural resources like air or water.²¹ Saleable rights would provide the mechanism for this system. Against this, some authors have argued that the introduction of market principles into economy was a decisive factor for the depletion of resources. Before the advent of the market, traditional mechanisms occupied its place. Often these were based on tribal or kinship relations and were nature-conserving (Victor 1980: 205). As Victor, drawing on Polanyi (1944), maintains, the market principle in fact introduced a damaging tendency. Under market conditions the earth is no longer the property of the people who live on it, but an exchangeable good. Under market conditions a company (or any other) may buy a piece of land and extract resources in order to use them up by producing a specific good or simply to sell them. When the job is done, the company moves away and leaves the place. It leaves it to (sometimes) anonymous future inhabitants. The difference between a society in which the inhabitants of a certain area are the *common* owners of the earth, taking the best care of it, and a society in which land has become a commodity, then, is that the former seems to be more apt to avoid ecological problems than the latter. It is assumed that people who own a certain thing commonly (land in our case) will take the best care of it. This could also be interpreted as an example of a successful assurance game (s. 1.3.6). But here neo-classical economists would argue that it is quite the contrary. They have it that the trouble begins with common property:²²

Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for centuries because

²¹ Beckerman (1974) concedes that the market principle fails to prevent pollution since nobody has property rights in natural resources like air or water.

²² Actually, Hardin is a biologist but the logic of his argument is comparable to what neo-classical economists would hold.

tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point, the inherent logic of the commons remorselessly generates tragedy. (Hardin 1980: 104)

This is so because as a rational being the herdsman seeks to maximize his gain. Since he is to get the full amount of increment if he adds one animal to his herd and he is only to share a part of the negative effects of overgrazing he concludes that the best thing he can do is add another animal to his herd. Hardin comments: 'But this is the conclusion reached by each and every rational herdsman sharing commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit—in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in the commons brings ruin to all' (ibid. 104).

Note that in one case the market is praised for preventing ecological problems whereas in the other it is accused of causing ecological problems. How can one explain these opposing judgements of collective ownership? An answer to this would certainly focus on the important role which *cultural values* play in cases where common property exists. If there are cultural patterns which prevent the common owners from overfishing, overgrazing, etc. there need not arise a *tragedy* of the commons. Only in cases where such patterns do not (or no longer) exist can the neo-classical argument come in. This has been rightly identified as a strategic point for bringing in a sort of 'environmentalist ethics'. Thus Hardin writes:

[T]he logic of the commons has been understood for a long time, perhaps since the discovery of agriculture or the invention of private property in real estate . . .

. . . but the inexorable succession of generations requires that the basis for this knowledge be constantly refreshed. (ibid. 105, 104)

The logic of the commons is understood mostly only 'in special cases which are not sufficiently generalized . . . the oceans of the world continue to suffer from the philosophy of the commons. Maritime nations still respond automatically to the shibboleth

of the "freedom of seas". Professing to believe in the "inexhaustible resources of the oceans", they bring species after species of fish and whales closer to extinction' (Hardin 1980: 105).

And Victor claims: 'These examples from history indicate that the expansion of the market system *created* the tragedy of the commons by weakening the traditional forms of social relations which had hitherto prevailed. It is the reconstruction of social structures such as these, combined with the propagation of an environmental ethic, that environmentalists argue is an essential ingredient in an effective environmental policy' (Victor 1980: 206).

However, if such an environmental ethics is not in sight, the problem must be posed in different terms. Rousseau addressed a similar set of questions in his *Discours sur l'origine de l'inégalité parmi les hommes*, using a model of a natural state which roughly corresponds to our above example of the commons (cf. Boudon and Bourricaud 1989: 313). His solution is to invest a superior power to regulate affairs in order to achieve optimal solutions. An optimal solution is one which would be preferable to all but cannot be brought about by rational individual action alone. However, this solution also has its limits. The limits are that public power is often as short-sighted as individual actors. Since ecological problems are complex and interwoven with one another, the future outcome of an adopted course of action in this field is *insecure*.

This has serious implications for socialist societies. As has been argued, countries with state ownership of the means of production and planning are less likely to produce ecological problems for two reasons. First, so the argument goes, socialist enterprises do not introduce prematurely certain (dangerous) technologies which are introduced prematurely in capitalism in order to gain extra profits. Second, because of central planning (and the absence of the profit principle) individual socialist enterprises cannot externalize their costs to the environment.

While it may be true that dangerous technologies are introduced in capitalism prematurely (in order to make short-term profits), it is not necessarily true that socialism does better in this respect. In fact, the actual record of socialist countries elucidates and confirms this point.²³ What can account for this?

²³ See some recent reports in Rosenblatt 1986 and generally Ziegler 1987.

My answer here cannot be exhaustive but I think the following factors explain a lot. In addition to what has been said above with respect to common property, I would add the following. It is not true that only private enterprises (profit maximizers) cause ecological problems. The same holds true for state enterprises and private consumers in capitalism, and for enterprises and consumers in socialist countries. One reason, therefore, has been explained by Max Weber: it is the expansion of the 'rationality principle' in the modern epoch. In capitalist enterprises economic calculation is carried out mainly by means of money, which is, according to Weber, the most rational way of orientating economic activities (cf. Weber 1978: 86). As Weber also makes clear, a planned economy which is based on the principle of need satisfaction and on calculations in kind 'would have to determine "value-indicators" of some kind for the individual capital goods which could take over the role of the "prices" used in book calculation in modern business accounting' (ibid. 103). No matter how this difficulty is resolved, whether by production quotas or in value, socialist countries also try to enhance economic efficiency.

But are socialist countries not in a better position in so far as they can anticipate ecological costs, if not ecological problems? My answer is that state planning is not sufficient to avoid ecological problems. Six reasons oppose such a hope:

1. As already pointed out above, (at least) high-risk systems produce ecological problems. Hence, no matter what basic property relations in a certain society obtain (private ownership or state ownership), 'normal' or 'systems' accidents are likely to occur. Because of their scope and dangerous potential, these complex technologies can create ecological problems for a great number of people over a long period of time.
2. A second factor which makes central planning problematic as a solution to ecological problems is the feature of unintended consequences (see s. 1.3.2) which, if true, is a general threat to 'planning the future'.
3. Collective ownership (for example of means of production) may lead to the 'tragedy of the commons'. Also in this case we have the spectre of externalities (social costs) which we have already defined as one of the causes of ecological problems.

Given certain conditions (see s. 1.3.6), the logic of public goods can be applied here.

4. As has been pointed out, the price system in countries like the Soviet Union does not allow for taking into account the scarcity of resources. This is so because the dominating ideology forbids establishing prices which are not the result of labour time (dogma of the labour theory of value, cf. Kupilik 1982: 169–70).²⁴ Moreover, the specific mechanisms of 'success indicators' (ibid. 171) and departmentalism (Ziegler 1987: 35) lead to a reward system which does not provide incentives for concern for the environment. On the contrary, 'environmental protection is clearly identified, both by the central leadership and by virtually all bureaucratic organizations, as low priority' (ibid. 161).

5. Although the Soviet Union is a country with one of the most ambitious environmental legislations, existing law is not enforced (see Goldman 1972, as cited in Kupilik 1982). As Ziegler put it, 'the irony of Soviet enactments, which are superficially quite impressive, is their ineffectiveness in application. In form, Soviet law is a paradigm of environmentalism; in application, it often becomes a paradox of neglect' (Ziegler 1987: 81). Firms which are found guilty of polluting are punished only with (relatively) small fines. This leads in effect to the result that firms take into account the cost of the fines in their budget (Kupilik 1982: 171).

6. A further reason why effective concerns about environmental protection are blocked is the widespread belief that the Soviet Union is so huge that it can afford the negligence. Soviet official culture and Soviet popular culture frequently make a fetish out of the sheer size of the Soviet Union. This is an attitude 'similar to the frontier mentality of the American pioneers who, in the nineteenth century, slaughtered millions of bison and passenger pigeons in the mistaken belief that their numbers were inexhaustible' (Ziegler 1987: 25).

Whereas (1), (2), and (3) apply to socialist societies in general, (4), (5), and (6) are historically specific traits of Soviet society. We may imagine a non-Soviet type of socialism which is not committed to the labour theory of value and which enforces its

²⁴ See also Kramer 1973; Kelley *et al.* 1976; Ziegler 1987: 167.

environmental laws; but even in this case we would have (1) to (3) as candidates for ecological problems. The outcome of this discussion, then, is, contrary to the intuitions of many, that private property is a less probable factor in causing ecological problems and that a socialist society is in no *structurally* better position to avoid ecological problems. As Ziegler rightly observed, 'environmental disruption has plagued industrial nations irrespective of economic or political structures' (Ziegler 1987: 3). This is so because there are no mechanisms built into socialism which would avoid these problems. Of course there are ecological problems in capitalist societies which are connected only to short-term profit considerations but these do not explain the broader phenomena or their existence in socialist countries.

1.3.6. Prisoners' dilemma

No matter whether the market combines the private producers and consumers in a society or whether forms of common property exist, we may try to apply the logic of public goods to ecological problems. Game theory has formalized this approach in models like 'isolation game' or 'prisoners' dilemma' (PD) (cf. Luce and Raiffa 1957). They were introduced into the social sciences by Olson's (1965) influential book. Sen presented the prisoners' dilemma in the following way:

Two prisoners are known to be guilty of a very serious crime, but there is not enough evidence to convict them. There is, however, sufficient evidence to convict them of a minor crime. The District Attorney—it is an American Story—separates the two and tells each that they will be given the option to confess if they wish to. If both of them confess, they will be convicted of the major crime on each other's evidence, but in view of the good behaviour shown in squealing, the District Attorney will ask for a penalty of 10 years each rather than the full penalty of 20 years. If neither confesses, each will be convicted only of the minor crime and get 2 years. If one confesses and the other does not, then the one who does confess will go free and the other will go to prison for 20 years. (Sen 1982: 62)

The probable outcome is that 'each prisoner feels that no matter what the other does it is always better for him to confess. So both of them do confess guided by rational self-interest, and each goes to prison for ten years' (ibid. 63).

We can take this 'game' as a two-person game and apply its logic to an n -person game. In an n -person game the following modification occurs, as LiFeldman observed: 'Unlike the Prisoners' Dilemma, where all parties must cooperate to achieve the solution, a free rider case [which is represented in the n -person game] allows for some defectors' (LiFeldman 1986: 25). Important is 'some' here, for if a considerable number of players defect, we would be in the logic of a two-person game again, where one part opposes the other: co-operation stands against non-co-operation. Rawls also referred to a free-rider case when he wrote:

Where the public is large and includes many individuals, there is a temptation for each person to try to avoid doing his share. This is because whatever one man does, his action will not significantly affect the amount produced. He regards the collective action of others as already given one way or the other. If the public good is produced, his enjoyment of it is not decreased by his not making a contribution. If it is not produced his action would not have changed the situation anyway. (Rawls 1972: 267)

In order to apply the logic of public goods to ecological problems, two conditions must be fulfilled. The first is that ecological problems be manifest, the second that their removal create a 'public good'. The first condition is not always met because many ecological problems are invisible and accumulate unknown; for a long time they do not show up as a problem. Only if an ecological problem is obvious (if, for example, pollution is taking place before everyone's eyes) and its stopping would generate a public good, could collective action lead to the production of that public good. Consider the case of some towns which pollute a river or a sea. Here we have an n -person game which can be represented as follows. Since each actor has to decide his actions *vis-à-vis* all other actors, we may speak of 'me' as the actor in isolation from the 'others'.

The expected outcome, then, is suboptimal as my preference will always be not to co-operate, since whatever the others do, that will put me in the best position; not co-operating gives me a free ride if all others produce the public good and I am not worse off in case they do not; then I have not paid any costs (but the water stays dirty). Note that even a contractual solution needs enforcement, for 'even if a contract is arrived at, it will be in the interest of each to break it' (Sen 1984: 136).

		All others	
		Do not co-operate	co-operate
Me	Do not co-operate	dirty water (no cost to me) 2	clean water (no cost to me) 1
	co-operate	dirty water (cost to me) 4	clean water (cost to me) 3

FIG. 1.1

However, there may be an optimal outcome, if we consider somewhat different preference patterns. As Sen put it, 'In the special case when everyone else [co-operates], the individual now prefers [to co-operate] himself' (ibid. 137). In this 'assurance game' the isolation paradox can be resolved. Now an individual's dominant strategy is no longer non-co-operation. Provided that there is perfect information for the players, then they will all choose co-operating 'in the safe expectation that others will too, since it will be in everyone's interest to do so' (Shaw 1984: 26). In cases where the game is repeated and the number of the players is small, the preference ranking in Fig. 1.1 would be modified: 2 and 3 are changing places. Apart from enforcing rules, then, there exists the possibility that 'selective incentives' induce actors to co-operate. These are offers which one can hardly refuse. Examples include cases where an incentive exists to do x and the threat of punishment when not doing x . Hillel Steiner (1974: 36 ff.) coined the term 'throffer' for such combinations.

But not all ecological problems do dissolve so easily. One reason for this is that not all ecological problems arise out of their public goods character. I shall return in chapter 2 to this problem, discussing some problems connected to regulatory policy.

1.4. Summary

Summarizing the causes for ecological problems, I should make clear that there can be no monocausal explanation. All of the factors may be causing an ecological problem under certain conditions. These 'certain conditions' are partly contained in the other factors such that the combination of two or more factors is sufficient to cause an ecological problem. The only exceptions are high-risk systems which represent a sufficient factor on their own. Take technology, for example. It is damaging only if (in the case of pollution) 'ecological costs' can be externalized and no agreement with other concerned parties is reached. It is damaging (in the case of resources) only if market prices make it profitable to exploit these resources and if no laws restrict the exploitation; the 'tragedy of commons' is only damaging if neither cultural values nor superior powers prevent the damage.

To conclude, the salient points of this chapter are the following. (1) I have distinguished the anthropocentric from the ecocentric approach showing the former's superiority. (2) In so doing, it is possible to derive the criteria for evaluation (they are dependent on man's interests, needs, pleasures, and desires). (3) I have defined what counts as an 'ecological problem' and that it results (as an *abstract possibility*) from man's dealings with nature. (4) I have then looked at the causes for the *actual emergence* of ecological problems, using approaches from game theory and social and economic theory. The result is that technological and institutional complexity constitute a severe barrier for conscious human design, hence for a world without ecological problems. (5) Private property cannot count as a prime cause of ecological problems; neither can any other single factor (except high-risk systems). (6) The market and systems of common property may be equally beneficial or detrimental to the environment, depending on the concrete historical and cultural conditions.

2 Ecology, the Social Sciences, and Marxism

Prometheus, der den Menschen den Blitz ausgeliefert, aber sie nicht gelehrt hatte, ihn gegen die Götter zu gebrauchen, wurde wegen seiner Tat, beziehungsweise wegen seiner Unterlassung, im Auftrag der Götter, von Hephaistos dem Schmied an den Kaukasus befestigt. (Heiner Müller, *Zement*)

Environmental reports in the 1960s and early 1970s disturbed the world public with their alarming tone. They presented scenarios which predicted ecological collapse within a few decades. According to these studies, main ecological problems were population growth, depletion of resources, and pollution. Since then, ecological topics have proved to be a forceful challenge to the Marxist left. One only needs to recall the debate which was sparked off by the first report of the 'Club of Rome' published in 1972. Consider, for example, the comment of a shrewd writer like Enzensberger who in a typical way expressed a widespread leftist standpoint:

The ecological movement has only come into being since the districts which the bourgeoisie inhabit and their living conditions have been exposed to those environmental burdens that industrialization brings with it. What fills their prophets with terror is not so much ecological decline, which has been present since time immemorial, as its universalization. (Enzensberger 1974: 10)

However, this defence of the class-struggle orientation did not make Enzensberger blind to the importance of ecological problems as such. As he put it:

[A]n ideological critique is only useful when it remains conscious of its own limitations: it is in no position to handle the object of its researches

Prometheus, who delivered the lightning flash to men but did not teach them to use it against the gods, was, in consequence of his act—or rather in consequence of his default—fastened to the Caucasus on behalf of the gods by Hephaistos the blacksmith.

by itself. As such it remains merely the interpretation of an interpretation of real conditions, and is therefore unable to reach the heart of the problem. Its characteristic gesture of 'unmasking' can turn into a smug ritual, if attention remains fixed on the mask instead of on what is revealed beneath it. The fact that we name the interests which lie behind current demographic theories will not conjure the needs of a rapidly growing population out of existence. An examination of the advertising campaigns of the enterprises involved does not increase the energy reserves of the earth by a single ton. And the amount of foreign matter in the air is not in any way reduced if we draw attention to the earlier history of pollution in the working-class quarters of Victorian England. A critique of ideology which is tempted to go beyond its effective limits itself becomes an ideology. (Enzensberger 1974: 19)

The two statements by Enzensberger typically express a sort of leftist schizophrenia. On the one hand the evils of modern societies, such as ecological problems, are linked closely to the existence of capitalism and its class structure; on the other hand the existence of these problems as such is recognized, that is, the challenge to every type of modern society based on industrial technology is perceived.

Among contemporary Marxists (or authors who are close to the Marxist body of thought or influenced by it in the wider sense) there seem to be two broad spontaneous reactions to the ecological challenge. (I shall consider first these more general attitudes and then turn to a *specific* variant.) The first is the orthodox reaction which claims that ecological problems are the result of the workings of the profit principle and of the institutions of private property. The second reaction claims that Marxism has concentrated too much on the exploitation of man and the domination over man, thereby neglecting the aspect of exploiting and dominating nature. I shall start my discussion with the second type of reaction.

I have already quoted Anthony Giddens (see Introduction) who charged Marx with a 'Promethean attitude' which he thinks to be indefensible in the twentieth century. Norberto Bobbio, in a similar way, writes that:

[a]fter two thousand years the Promethean myth of humanity as having dominion over nature has reached a crisis: nature is rebelling against its subjugation just as the slave of other ages (of all ages). The central theme of Marxism was the exploitation of man by man. But now

everyone must face up to the issue of how human beings as a species have exploited nature. It has been widely accepted in the past that it is inadmissible, at least morally, for a human being to be treated as an object, but now nature too can claim the right not to be treated any longer as an object. (Bobbio 1987: 176)

I leave aside for a moment the aspect of whether nature has or should have rights. What I am interested in here is above all the conclusion which Bobbio draws. He asks the following rhetorical questions: 'But is it still possible today to ignore the potentially catastrophic consequences of the unconditional submission of nature to the reign of the human species? Is it possible to persist in being blind to the fact that a humanistic ethic whose basic precept could be formulated in terms of "treat all human beings as persons, i.e. as an end in themselves, but nature as an object, i.e. as a means" taken to extremes, could eventually cause nature to wreak vengeance on humanity?' (ibid.).

Both Giddens and Bobbio see the evil in the 'expansion of productive forces' or in the 'domination of nature'. But in my view Giddens confuses expansion of productive forces 'as such' with productive forces which are detrimental to the natural environment. Similarly, Bobbio sees in the very fact of domination the possible cause of things going wrong. As I said, this may be a mere verbal quarrel. However, Bobbio's application of the Kantian categorical imperative to nature would leave modern industrial societies without any concrete guidance for action. If, for the sake of the argument, we accept Bobbio's suggestion, we should proceed in the same way as in the social realm, that is, we have to reckon that a liberal society which follows Kant's demand has to institutionalize further rules and regulations to enable a legal system to be effective. Likewise, we would need criteria for action in the realm of transforming nature. It is my contention that criteria which are based on anthropocentric premisses are performing this task best.

Let me now turn to the second type of response which I mentioned in the beginning, Marxist orthodoxy. This response has it that with the emergence of ecological problems capitalism has once more shown its incapacity to provide material wealth and security. The cause of ecological problems is clearly seen in the fact of capitalist relations of production. As Ernest Mandel put it: 'The evil is private property and competition, that is, the

market economy and capitalism. All catastrophes, including the irrational and inhuman roads that technology is led down, derive from this social base and from it alone' (Mandel 1975: 16). In a similar vein, albeit more carefully, Cohen writes that 'whatever the size of the problem would otherwise be, it is certain that capitalism aggravates it' (Cohen 1978: 322).

Now these formulae seem to imply that the reverse is true as well: that the abolition of private property will lead to a society without (or with fewer) ecological problems. However, many orthodox Marxists have felt the inadequacy of such a claim. Therefore, they turned the challenge of *ecology* into a challenge for *capitalism*: ecological problems are here interpreted as yet another mechanism causing capitalist crises and, eventually, the breakdown of capitalism. If we recall for a moment some of the classic themes of orthodox Marxism, we would certainly include the following:

- the labour theory of value,
- the theory of capital accumulation,
- the theory of class,
- the theory of revolution.

Along the lines of these different theoretical elements, not only orthodox Marxists, but many leftists as well, have been seduced to restate an ecological critique of capitalism which tends to replace the so-called historical subject (working class) with *nature*. Nature is then seen as producing all values and all wealth, it is seen as exploited, and it has to be liberated. This approach seemed to offer the leftist a theoretical tool which would no longer commit him to a response typical of the orthodox Marxist's. The natural response from a (Marxist) leftist to ecological problems was to deny the central claim of the greens that ecological problems were global in character and a product of industrial societies, whether socialist or capitalist. The left response tried to point out that ecological problems were above all produced by the profit mechanism of capitalism, or that they were a class question, or that they were simply invented by the ruling classes to prevent the workers from perceiving their 'real' class interests . . . and so on.

Now, on the basis of this new image, every instance of an ecological crisis could be seen as leading to capitalism's final

crisis. This theoretical schema (and its 'green' interpretation) explains quite well the fact that many leftists changed their former class-struggle orientation to a green orientation, in the hope that capitalism would collapse. What changed was the reasoning behind that hope. The 'old' left view saw it collapsing for economic reasons, the 'green left' for ecological reasons. In this sense the orthodox Marxist orientation and the green fundamentalist position have quite a few affinities.

Orthodox Marxism was little prepared for the ecological challenge. Everything it had to offer was either out of step with reality or was to be taken over by a 'green logic'. However, the opposition which was created thereby is a false opposition. Orthodox Marxists are plainly wrong in believing that capitalism is the main cause of ecological problems and the green Marxists or leftists (in the above sense) are wrong in believing that capitalism will fall because it suffers ecological crises. Yet, what is more, the latter have taken over a piece from the baggage of ecological fundamentalism, that is, the ecocentric world-view.

I now briefly address a more specific Marxist argument. This is expressed by authors like Walker (1979) and Benton (1989) who think that historical materialism has to be revised because in its traditional form it did not sufficiently consider the problem of scarcity of resources. However, this point stresses only one of the two main ecological problems, almost completely neglecting the other: pollution. But apart from this reduction of the problematic the proposal seems of little help in the project of a green reconstruction of historical materialism. The charge against Marx that he saw nature as something 'socially constructed' does not convince. True, there are *natural* limits to everything, including society. But the point is, rather, that societies have found ways to overcome these limits and are also trying to do so in the light of present ecological problems (see too the argument based on the second law of thermodynamics: entropy; see Georgescu-Roegen 1971). However, it is characteristic for societies to behave in a 'negentropic' way, as pointed out, for example, by Luhmann (1989c). Two questions arise in this context: first, to what extent are societies capable of doing so and, second, is this right or wrong? Benton seems to address only the second question, assuming that it is wrong. On the basis of this evaluation he infers the claim that Marx 'overestimated'

the transformative possibilities of modern technology. But this seems to confuse the factual question whether such transformative potentials exist with the evaluative question whether we like them to be set free. As regards the factual question, I believe that Marx's view of technological dynamism corresponds more closely to reality than Benton's. Imagine only electronic and biochemical technologies. The evaluative question again has two sides: we may imagine beneficial and detrimental effects of such an unleashing of technology. My suspicion is that Benton arrives at his conclusion only by implicitly assuming that an unleashing of technology leads to undesirable effects. In other words: he confuses the undesirable with the unfeasible.

If this sketch of Marxist reactions is correct, it becomes understandable why orthodox Marxism has almost completely vanished and why leftists, in so far as they were relying on standard Marxist assumptions, got confused. Orthodox Marxism has vanished from the scene, leftism has turned green,¹ and Marxists have become ecologists. However, there seems to be an unchanged world-view standing beyond the switch in orientation, in so far as radical leftists have turned into ecological fundamentalists. Both reject the capitalist system, be it for economic reasons (exploitation, crises) or ecological reasons. But this switch is not reflected properly by their adherents. The fact that orthodox Marxism failed in tackling the ecological problematic does not lead necessarily to the conclusion that Marx's thought is equally impotent in this respect. Such a conclusion could only be drawn if it could be shown that Marx's basic premiss, i.e. the Promethean model, was fatally flawed. My contention is that this is not the case and that the potential of Marxism therefore has not been exhausted. The big point for debate can be defined around the terms 'domination of nature' and 'anthropocentric world-view'.

To explain this in greater detail, I distinguish between an *eco-centric* and an *anthropocentric* world-view. The former believes that ecological problems are basically the result of our modern attitude towards nature—an attitude which tries to manipulate nature as if it were an object. The latter has it that nothing is wrong with such an instrumental view of nature; that ecological

¹ Among other things. It has also turned feminist, ethnic, and so on.

problems do not necessarily follow from such an attitude; and, what is even more, that only the anthropocentric world-view allows us to develop criteria on which we can base our alteration of the present state of affairs (cf. Norton 1987: 12 and see below).

Lukes (1985) has argued that whenever Marx engages in arguments of a moral or normative sort, his discourse is one concerned with *emancipation*, not with *Recht*. I broadly agree with this general statement. However, I do not see that this theoretical decision (no matter if consciously taken by Marx) was a fatal error. True enough, the Marxist tradition, following Marx, ran into all kinds of difficulties by condemning any discourse of *Recht* as abstract, formalistic, and bourgeois. But this tradition of dogmatic Marxism was never committed to the other part of the distinction, for it did not take seriously the discourse of emancipation.

No matter what its own self-description is, in my view, Marx's theory employs two levels of analysis, first, a level which we can call descriptive, explanatory, or historical; and second, a level of criticism. Both levels are bound together in the following poetic statement: '[T]hese petrified relations must be forced to dance by singing their own tune to them!' (CW iii. 178). It was not by accident that Marx used the term 'critique' in the title of many of his major writings, above all his life-long project of the 'Critique of Political Economy'. Raymond Geuss makes a similar distinction, a distinction between 'scientific' and 'critical' theories. As he put the difference:

A critical theory is structurally different from a scientific theory in that it is 'reflective' and not 'objectifying', that is, it is not just a theory about some objects different from itself, it is also a theory about social theories, how they arise, how they can be applied, and the conditions under which they are acceptable. (Geuss 1981: 79)

What is, then, for Marx the standard of critique? How does he evaluate what social theories had to offer at his time? To this question there have been among Marxist scholars, broadly speaking, two responses. The first is a naturalistic answer which says that capitalist societies will lead to their own destruction and supersession as a result of the working of the laws of motion of capitalism itself. The proletariat is the social

class which fulfils the historical role as grave-digger for capitalism and as a foundation stone for the new, communist society. In this version, critique is a process which exists, on a quasi-ontological level, out there in reality. It is the task of the communist to become its 'mouthpiece'. This is the interpretation of Marxism to which above all Althusser and his followers have given great publicity; it is *Marxism as a science*.

The second response commits itself to some normative criteria. Marx engages in such an enterprise when he compares capitalism with earlier modes of production and states that people in earlier epochs were freer and happier. Here Marx obviously employs a notion of the good life which is linked to his philosophical anthropology. The theory of human nature which we encounter in Marx is a theory which states several basic traits of human beings: that they are natural *and* social, where social embraces the meaning both of 'co-operative' and of 'civilized'. It also includes that they are creative and possess a projective consciousness. They transform nature in co-operation with others, and they appropriate culture in the same way. This stress on creative activities is of the greatest importance if one is to understand Marx's critical approach properly.

What matters for Marx is *human self-development*, man's 'working-out of all his creative powers' (*Grundrisse*). This is the objective trend which Marx discerns in the history of mankind, and it is at the same time a normative claim about the good life, as seen by Marx. Therefore, I interpret Marx's statement that the productive forces develop throughout history and that they must be unfettered if social relations impinge upon them, in the wide sense which I explained a moment ago as a process of unfolding human self-realization. Orthodox Marxism has always interpreted this statement from the 1859 *Preface* in a narrow economic sense. Accordingly, capitalism was criticized for not developing enough economic efficiency. Whereas the weakness of this interpretation becomes obvious, not least by experiences in post-war Europe, the broader interpretation still has something important to say about the development of modern societies and about its evaluation as well.

According to Marx, the creative drive of humans can be thwarted from many directions. Marx distinguishes between 'heavenly' and 'earthly' powers. The first are magical or religious

powers, the second are powers which grow out of social relations and oppress the 'Promethean' project of man. Interestingly, both powers are, according to Marx, themselves creations of men; they are, therefore, liable to be dissolved and replaced by a rational order. The method behind this type of reasoning strongly resembles Kant's, who defined Enlightenment as the 'exit of mankind out of its minority/immaturity which was brought about by its own fault'. We can trace this line of thought through the whole work of Marx. In his early writings he discusses this theme under the label of 'alienation', in *Capital* he discusses it under the label of 'fetishism'. Right in the first chapter of *Capital*, we find a section entitled 'The fetish character of commodities and its secret'. Here Marx explicitly uses the analogy between religious visions and religious powers on the one hand and capitalist mystification on the other. It was from Feuerbach that he took over the motto that all criticism has to start with the criticism of religion. Marx summarizes the analogy between religious and bourgeois illusions in the following way: 'As, in religion, man is governed by the products of his brain, so in capitalist production, he is governed by the products of his own hand' (*Capital* i. 582).

However, this is a state of affairs which is, according to Marx, unworthy of human nature. It must, therefore, be abolished and replaced by social relations which are the conscious product of human enterprise. Note that I am going beyond the point where Marx stopped his analysis. For him, the institutions of *class* society represented in the first place the instances for the frustration of human self-creativity. However, I believe that even supposing that class oppression had vanished, modern societies would still not be able to control their fate, humans would still suffer from the workings of 'alien powers' which they themselves brought into existence and for which ecological problems give a good illustration. Therefore, I propose to adopt a double concept of alienation, one which focuses not only on the social relations like capital, abstract labour, and commodity character of goods but also on their material aspects, like productive forces, use-values, and concrete labour. This approach takes seriously Marx's discovery that the double character of commodities (being the unity of use-value and exchange-value) corresponds to the double character of labour (which is the unity

of concrete, transformative, and abstract, surplus-producing, labour].

The ecological debate only recently became a topic for social theory. There have been many works which were directed, instead, against some dominant paradigms in economic and social theory, like those of Mishan (1967), Meadows *et al.* (1972), Schumacher (1974), Gorz (1977, 1980, 1983). There have been 'ecological' analyses from economists like Georgescu-Roegen (1971), Daly (1980); works from moral philosophers like Feinberg (1980), Passmore (1974), Regan (1982), Jonas (1984); works from philosophers of technology like Mumford (1977), Rapp (1978)—but no outstanding contribution from sociology. There are exceptions in works on a meta-theoretical level, inspired by the sociology of knowledge, like Kitschelt (1984), van den Daele (1987), or Oechsle (1988). There are also works from organizational sociology, most notably Perrow (1984). The works of Bühl (1981) and Luhmann (1989c) also have an organizations and systems theoretical background. This seems to be due to the fact that sociology, having its object of inquiry in society and not in nature or in the relation between nature and society, must be blind to ecological questions.

This situation was reflected in Chapter 1 where, apart from considering Merton's and Perrow's analysis, I focused mainly on approaches which developed in philosophy and economics. Now it has often been noted that the economists' and the environmentalists' views are inevitably at odds with each other. The first attribute no intrinsic value to nature as such and think in short-term economic outcomes, as affected by actors' preferences. The latter, by contrast, pursue a 'deontological' argument and think that nature has an intrinsic value which should be respected and preserved. Hence their concern about nature is profound and the time horizon is rather wide, stretching also to future generations. The actors' preferences of the economists are criticized as a distorted version of 'real human needs'. In this chapter, I try to propound a position which avoids the pitfalls of both approaches. Odd though it may seem, I take sides with the economists in denying that any intrinsic value in nature exists. This instrumentalist view of nature, however, does not squeeze out ecological concerns—on the contrary, it does so only if the economists' interpretation of 'value' is accepted. However, in

my view, the economists' approach to ecological problems is far too narrow. In continuation of my argument in Chapter 1, I propose to enlarge the instrumentalist view of nature (by adding scientific, aesthetic, and ethical elements to it) and subsequently to arrive at a position from which it is possible to evaluate ecological problems and possible solutions from a *human* standpoint, taking human needs and interests (s. 2.5) as a starting-point, rather than narrow, short-sighted economic preferences. In so doing, I take sides with the ecologists' concern about our natural environment. It seems commonly accepted that the economists' denial of any intrinsic value in nature and the environmentalists' affirmation of precisely this value are the only possible (extreme) ways to conceive of the problem. From this, it is concluded that we face a dilemma which we cannot avoid. The only thing we could and must do is to make a choice between these opposing claims: either we choose 'nature', and 'life', or we choose 'wealth', and 'efficiency'. When I claim that we have a third possibility, I try to espouse the environmentalists' concern about the natural environment without committing myself to the metaphysical notion that nature has an intrinsic value *for itself*. In this chapter, I want to show how Marx's theory concords with such an approach, thus proving its value for investigating ecological problems. Especially important is Marx's distinction between 'wealth' and 'value'.

The present chapter proceeds as follows. I first try to relate the findings of Chapter 1 to Marx's theory in a direct way (s. 2.1) and then reconstruct some of Marx's arguments from within his body of thought as laid out in section 2.3. In section 2.4 I will discuss the concept of nature in Marx, and in section 2.5 Marx's philosophical anthropology.

2.1. How can we relate Marx to ecological problems?

Recall the discussion of section 1.2 where I considered several claims with respect to ecological problems. How is it possible to relate elements of Marx's theory to them? As will be demonstrated in this section, Marx shared an anthropocentric approach and had something to say on population growth, future generations, and unintended consequences of human action.

2.1.1. *Marx's anthropocentrism*

I think it is plain that Marx had an anthropocentric world-view and did not set up moral barriers to the investigation of nature. He was clearly a follower of Enlightenment thinkers like Bacon and Descartes. However, both have become the main scapegoats in ecological literature. Both are accused of having helped to establish a world-view which is in favour of dominating nature. But the modern approach towards nature does not amount to a 'violation' of nature. As Bodei has made clear, it was the *ancient* view of nature which saw in the use of mechanics a violation of nature:

In the ancient world the machine was often conceptualized as an alteration 'against nature' within the balance between man and nature. Apart from this, the notion *mechanè* originally means 'cunning', 'outwitting', 'trick'. Only much later does it denote the machine in general . . . Thus the machine is considered by Aristotle and by a part of the tradition as a sort of knowledge and a technique against nature (*para physin*), since it violates the laws of nature. Conversely, medicine, for example, is according to nature (*katà physin*), as far as it promotes it. (Bodei 1983: 17–18, my translation; cf. Spaemann 1980: 191)

A corollary of the ancient view of nature was the fear that nature might take her revenge if mankind tried to harness her: 'However, the outwitted nature which has been caught by surprise by sophisticated human beings is able to take her revenge and punish those who dared to challenge her, who tried to break her eternal laws' (Bodei 1983: 17, my translation). We find this thought even in a famous passage of Engels's *Dialectic of Nature*, and in more drastic forms from a religious strand of the ecological movement: here, nuclear power is simply the work of the devil.

Modernity sees nature as an object of utility which fulfils human needs and desires. In paving the way for a modern outlook, apart from Dante, Pico della Mirandola's *De hominis dignitate* is of crucial importance. Pico criticized the ancient view sharply. According to him, God did not attribute a fixed point to human beings in the 'hierarchy of Being'. Instead, he attributed to humans the power to change their place on this scale, so that they could sink down and become animals, or they

could rise up and become God-like. Such heresy was not to be embraced until the advent of technological breakthroughs based on scientific discoveries. Even before Pico, Dante saw in human nature the potential for a transformation of the world, albeit primarily in an aesthetic sense. When Dante says that we have to praise human nature which produces so much beauty² this refers to aesthetic standards, but, nevertheless, the reference point is clearly human. What the human essence is can be deciphered from art. This tradition, which includes writers like Vico, Rousseau, Schiller, Humboldt, and Herder, was also to be inherited by Marx. While there is little evidence that Marx was familiar with the work of Pico, he was a great admirer of Dante and took up Italian Renaissance thought via Giambattista Vico.³ However, as we shall see, Marx extends the argument of the artistic realization of human essence to technology and industry.

If nature is harnessed, it is not by violating her laws, but by obeying them. Marx takes this point from Bacon and distinguishes between two general forms of mankind's relationship with nature. The first is the form where nature was merely 'appropriated', i.e. in societies of hunters and gatherers. In the second form, nature is not only appropriated, but also transformed. In the *Grundrisse*, he imagines a state in which agricultural communities appropriate 'ready objects prepared by nature itself for consumption . . . without any instruments whatever' (*Grundrisse* 492). A state of nature may be imagined in which 'the free gifts of nature [were] abundant' (*Grundrisse* 612) and hence there was no need to develop technologies. However, Marx calls this appropriation of nature *production* and not consumption, since hunters and gatherers also have to develop certain capacities and abilities. But this is not the normal state, not even a normal original state, as he assures us in the same text (see *Grundrisse* 492). In *Capital*, Marx states more explicitly that man can produce nothing without technology (see *Capital* i. 352; in the *Paris Manuscripts* he had already spoken of industry as the open book of man's essential powers, the perceptibly existing human

² Cf. ch. 1 n. 6.

³ For the influence of Dante on Feuerbach, see Wartofsky 1977: 119; on Hegel, see Dobbins and Fuss 1982.

psychology, *CW* iii. 302) and the development of productive forces as largely dependent on geographical factors:

Where nature is too lavish, she 'keeps him in hand, like a child in leading reins'. She does not impose upon him any necessity to develop himself. It is not the tropics with their luxuriant vegetation, but the temperate zone, that is the mother-country of capital. It is . . . the differentiation of the soil, the variety of its natural products, the changes of the seasons, which form the physical basis for the social division of labour, and which, by changes in the natural surroundings, spur man on to the multiplication of his wants, his capabilities, his means and modes of labour. It is the necessity of bringing a natural force under the control of society, of economizing, of appropriating or subduing it on a large scale by the work of man's hand, that first plays the decisive part in the history of industry. (*Capital* i. 481, amended translation)

This presupposes that the producers have some ends which transcend the 'normal' end of providing food and shelter. In this means-ends relationship, human beings try to get something from nature which is not immediately there, or to manipulate and control natural processes to a certain degree. This higher form of *Stoffwechsel* presupposes the use of specific technologies. To denote this specific trait of humans, that is, that of being natural beings which are able to 'steer' some parts of the rest of nature, Marx used the term 'domination of nature'. True, the notion of domination is value-laden, as is the notion of exploitation. However, both offer us a possible description of man's relationship to nature; in the first case, where natural gifts are abundant, man can be conceived of as exploiting (in the sense of 'usufructing') nature; in the second case, where nature is actively transformed, it is harnessed or dominated.

I said above that the concept of 'domination' is always linked to a concept of the agents' interests. King Midas, by turning everything he touched into gold, can hardly be said to have 'dominated' his citizens, or even his own private life. His power was self-defeating since he was no longer able to feed himself. As the poet put it,

Therefore, thou gaudy gold,
Hard food for Midas, I will none of thee
(Shakespeare, *The Merchant of Venice*, III. iii)

Marx in one passage of the *Grundrisse* seems to reject the very idea of the domination of nature, since it would imply the breaking of a free will: 'Basically the appropriation of animals, land etc. cannot take place in a master-servant relation, although the animal provides service. The presupposition of the master-servant relation is the appropriation of an *alien will*' (*Grundrisse* 500, my emphasis).⁴ But the condition of breaking an alien will is a limiting case which is not of very much interest: it does not matter if domination is achieved by breaking or by respecting (or by transforming, influencing, manipulating, etc.) an alien will; it is only important that the outcome of domination serves the interests of the dominator. The question of whether nature possesses a will (or a soul) of its own, therefore, is primarily a question of religious interest. If we speak of taming wild animals such questions may arise. However, they do not arise if we speak of 'taming' a river, or, to take another example, of mastering an instrument. Imagine a musician who plays her instrument with virtuosity. We call her playing 'masterly', she masters her instrument. It is in this sense that we have to understand the domination of nature. It does not mean that one behaves in a reckless way towards it, in the same way as we do not suggest that a masterly player dominates his instrument (say a violin) when he works upon it with a hammer.

As we saw in Chapter 1, contemporary debates on ecology seem to conceive society's relation to nature either as one of harmony or as one of conflict. Often the former is seen as the desideratum, whereas the latter is seen as the current dreadful state of affairs. For Marx such an opposition makes no sense at all. In the *German Ideology* he emphasizes that mankind is always in unity *and* in struggle with nature:

[The] unity of man with nature has always existed in industry and has existed in varying forms in every epoch according to the lesser or greater development of industry, and so has the 'struggle' of man with nature, right up to the development of his productive forces on a corresponding basis. (*CW* v. 40)

⁴ From this it follows that another version of this model (which is usually endorsed by environmentalists) is as problematic: the notion of co-operation with nature—one cannot co-operate with a stone or a cat.

Nature, in Marx, is not anthropomorphous. Nature has no end in itself, it is man who imposes his ends on it.⁵ In order to do so, however, he has to respect the laws of nature. Domination does not imply violation: as Bacon put it in the *Novum organon*, 'nature to be commanded must be obeyed . . . man, being the servant and interpreter of Nature, can do and understand so much and so much only as he has observed in fact or in thought of the course of nature; beyond this he neither knows anything nor can he do anything' (Bacon 1986: 47). This is to say that man imposes his ends on nature, but he cannot harness or manipulate nature in an arbitrary way; he cannot make flour out of green wheat. 'All that man can do is to put together or to put asunder natural bodies. The rest is done by nature working within' (ibid. 47). An ecologist might argue that there exists a natural cycle or natural potential for a flower (in our case) to become a fruit and that men are bound to respect these cycles.⁶ But nothing in nature forbids us (to take another example) to *not* eat the ripe apple, to leave it on the tree and let it rot. On the other hand, if the apple is picked too early, this is not detrimental to nature, but to human nature: an unripe apple causes stomach-ache.

Natural cycles have no teleological structure, i.e. no immanent purpose, no stage which is naturally the highest. It is rather just by chance (as a product of 'blind evolution') that apples in a ripe state are beneficial to men. But even if we accept the teleological argument for a moment, its absurdity can be shown when we extend its scope and look at other cases. Take the case of rats, insects, or bacteria which reproduce quickly and are contrary to man's well-being: here man intervenes if he has the required technology to do so. Man's ends are thus intimately related to his 'human nature', a concept which is, as we shall see, crucial to Marx's analysis. But Marx's rejection of a teleological structure to nature does not make him blind with respect to ecological problems. An ecological concern is contained in his general position which views nature as man's inorganic body. This body must flourish if man is to flourish. As Marx writes in the *Paris*

⁵ Recall Hegel's famous phrase that the cork tree does not grow in order to deliver taps for wine bottles; or Voltaire's that the melon was not designed to be eaten by a family.

⁶ On the question whether nature operates in cycles, cf. Reiche 1984; Maurer 1973.

Manuscripts: 'Man lives on nature—[this] means that nature is his *body* with which he must remain in continuous interchange if he is not to die' (CW iii. 276). Any careless use of resources, any pollution of earth, water, and air which exceeds a certain degree may turn out to be detrimental to the well-being of human beings. The disruption of man's environment makes survival for the human species difficult, if not impossible. Marx considers the following possibilities for such a disturbance:

Capitalist production, by collecting the production in great centres, and causing an ever-increasing preponderance of town population, on the one hand concentrates the historical motive power of society; on the other hand, it disturbs the circulation of matter [*Stoffwechsel*] between man and the soil, i.e. prevents the return to the soil of its elements consumed by man in the form of food and clothing; it therefore violates the conditions necessary to lasting fertility of the soil. (*Capital* i. 474)

Marx is aware of the fact that man and soil are essential for a successful *Stoffwechsel*; they are the two basic elements of every labour process in every society:

If we look at the labour process in the abstract, one can say that basically only two factors come into play: man and nature (labour and the material substratum of labour) . . . Conceived in this way, the soil and labour are the original factors of production. Products determined for labour, i.e. produced work material, means of production, means for subsistence, are only derived factors. (MEGA II. iii. 1. 87)⁷

With regard to the material aspect, i.e. the production of use-value, the production process of capital is a labour process. As such, it exhibits all the characteristics which this process assumes under the social forms of production in their diversity. In other words, these characteristics are determined by the nature of labour as labour. (MEGA II. iii. 1. 82)

There are two main sources of all wealth, the soil, and labour power. If man wants to prosper, these two also have to prosper. But capitalist production hampers this condition, it 'develops technology . . . only by sapping the original sources of all wealth—the soil and the labourer' (*Capital* i. 475).

⁷ All quotations from the *Marx-Engels Gesamtausgabe* have been translated by myself.

2.1.2. *Population growth*

Sometimes a Malthusian theme recurs in the ecological discourse; it is the contention that an increasing number of inhabitants of the earth will be left without the means of subsistence and/or that this will lead to an ever-greater degree of pollution. The first part of the contention is classical Malthusian whereas the second part could be called 'Neo-Malthusian'; it was expressed in the first reports of the Club of Rome, for example (cf. Meadows *et al.* 1972). Marx, throughout his work, never stopped criticizing Malthus's ideas. Consider the following passage from the *Grundrisse*:

Malthus's theory . . . is significant in two respects: (1) because he gives brutal expression to the brutal viewpoint of capital; (2) because he asserted the fact of overpopulation in all forms of society. Proved it he has not, for there is nothing more uncritical than his motley compilations from historians and travellers' descriptions. His conception is altogether false and childish (1) because he regards overpopulation as being of the same kind in all the different historic phases of economic development; does not understand their specific difference, and hence stupidly reduces these very complicated and varying relations to a single relation, two equations, in which the natural reproduction of humanity appears on the one side, and the natural reproduction of edible plants (or means of subsistence) on the other, as two natural series, the former geometric and the latter arithmetic in progression. In this way he transforms the historically distinct relations into an abstract numerical relation, which he has fished purely out of thin air, and which rests neither on natural nor on historical laws. (*Grundrisse* 605–6)

Marx disagreed with Malthus over the alleged different growth rates of natural and human population growth. But he could have agreed that there might arise such limits, since he said that we have to deal with 'very complicated and varying relations'. True, there is a certain hesitation on the part of many Marxists (and on the side of liberals, too) in acknowledging population growth as problematical since this seems to open the door for dictatorial measures of population control or for imperialist treatment of the 'irresponsibility' of third-world populations. However, this anxiety seems to me unfounded. If it were true that population growth presents severe problems for the prospering of mankind one can imagine that there might be non-

compulsory solutions which are feasible as well. But not even the results of demographical research seem to suggest that the planet will suffer in the near future from overpopulation. After all, this is a relative concept which depends on technologies and possibilities of providing the means for life. Up till now, mankind has succeeded in providing these means for an increasing number; that many people still die from starvation is primarily a result of the present mode of distribution of food. Consider now the Neo-Malthusian argument. In so far as an increasing population leads to ecological problems like littering or pollution, the phenomenon can be analysed with the logic of public goods (s. 1.3.6). To repeat: population growth is a relative notion. Consider a stagnating world population but a simultaneous concentration of population in certain areas. In this case we would not speak of overpopulation of the globe, but of problems of a large community which has to find a solution for the production of its public goods.

2.1.3. *Future generations*

The reference to future generations is a comparatively new issue in political philosophy. Bacon, writing in the late sixteenth century, was still of the old opinion that 'men must pursue things which are just in [the] present . . . and leave the future to the divine Providence' (*The Advancement of Learning*, cited in Passmore 1974: 80). As Passmore pointed out, it was in Kant's philosophy that

the idea of a duty to posterity assumes, perhaps for the first time, a central place. But although he exhorted [*zuraten*] men to sacrifice themselves for a posterity which would enjoy the fruits of their toil . . . Kant had too little confidence in man to suggest that the future is entirely his making. Providence, working through the laws of progress, is still for Kant the principal historical agent. (*ibid.*)

World-views of the twentieth century, and especially the ecologically inspired ones, are often committed to the position that only enormous sacrifices could prevent mankind from perishing in a nuclear disaster or in an ecological breakdown, thus making sacrifices for posterity inevitable. But if we ask for the arguments which would persuade us to make sacrifices for posterity, what can we supply?

Passmore has dedicated some attention to this problem. It seems that there are three possible types of argument. The first is religious, the second perfectionist, the third utilitarian. Leaving aside the first, I deal with the perfectionist and utilitarian approaches. The perfectionist view was endorsed by Kant and Fichte who thought that man will always strive towards a better world, towards the fulfilment of an ideal society. The utilitarian approach is presented in the Bentham, and Sidgwick, version.⁸

Bentham, and Sidgwick after him, were fully prepared to admit that we ought to take into account both the probability of the effects of our actions and also their remoteness; in general, we should place the greater emphasis on effects which are near at hand. Although the hereafter *as such* has the same moral importance as the *now*, this is not true when account is taken of its uncertainty. (Passmore 1974: 84)

Thus the utilitarian view (at least in this version) is not strong enough to ensure a concern for posterity, mainly because we are not able to calculate the probabilities of eventually detrimental actions to future generations. As Passmore concludes: 'So even if we accept the principle of impartiality and the utilitarian framework in which it is embedded, even if we accept the view that we ought not so to act as *certainly* to harm posterity, this does not appear to be a principle strong enough to justify the kinds of sacrifice some conservationists now call upon us to make' (ibid.).

Beckerman, a straightforward defender of economic growth and economic rationality, expresses the myopic view of many economists which has come under attack from the environmentalists when he says:

[I]f it can be said that there is a conflict between growth and the environment, it is equally true that there is a conflict between growth and food consumption or clothing consumption, or any other ingredient of current standards of living. In other words, one does not choose between consumption tomorrow and environment today; the choice is between consumption tomorrow and consumption today, irrespective of how consumption today or tomorrow is distributed between the environment and other uses of output. (Beckerman 1974: 29)

This quote makes sufficiently clear how economists, on the basis of their utilitarian approach, conceive of ecological prob-

⁸ Passmore erroneously calls Rawls a utilitarian, see Passmore 1974: 86–7.

lems. If something cannot be expressed in terms of monetary value then it is not likely to be taken into consideration for the calculation of utility or welfare. As Thomas Schelling noted, 'economic theory evaluates actions by their consequences and by the way the consequences are valued by the people who benefit or suffer' (Schelling 1983: 3). Usually, such evaluations are carried out by means of a cost-benefit analysis. When applied to questions of species preservation, the cost-benefit approach assesses the value of an individual species and, if several species are involved, sums the relevant assessments. As Norton pointed out, on the basis of such an approach 'no initial presumption in favour of species preservation is built into the analysis' (Norton 1987: 30). Beckerman exemplifies such an approach. He asks: 'How should society choose between consumption today and consumption tomorrow?' (Beckerman 1974: 27). The answer is: 'If a sacrifice of consumption today of £100 for purposes of investing in the environment can only yield an extra £90-worth of future welfare from the environment then it should not be undertaken' (ibid. 29). But this rules out the possibility that there might be environmental values which are appreciated 'as such', even if on balance there would in fact be such a trade-off as described. The problem with Beckerman's account is not, as he sees it, that the different preferences might be difficult to measure, but simply that he neglects the fact that people might not want the extinction of an animal species even if its actual financial value were negligible. His view, therefore, presents in a nutshell what is wrong with the economists' approach: their framework does not include human needs which cannot be rendered in economic terms ('preferences' which lead to a market price). To repeat the lucid statement of Norton, who captured the point very well:

The usefulness of a species may wait upon changes in human tastes and preferences, changes in income levels, developments of knowledge and technologies for using species, and changes in public policies. But if the species is extinguished before it is examined for usefulness or before such changes can take place, the resulting losses will never be known. (Norton 1987: 37)

The topic of future generations is an extremely difficult and complex subject which I cannot address in detail here. Therefore, I

limited the argument to questions of species preservation and the possible role of economic mechanisms in that process. Joan Robinson in her *Economic Philosophy* put her own scepticism about a concern for future generations in this way:

This problem cannot be resolved by any kind of calculation based on 'discounting the future', for the individuals concerned in the loss are different . . . The benefit from their sacrifices will come later and they may not survive to see it. The choice must be taken somehow or other, but the principles of Welfare Economics do not help to settle it. (Robinson 1962: 115)

But what about a theory of justice which is designed to tackle exactly such problems? Consider, for example, the approach of Rawls, who is not concerned with maximization of welfare, utility, or happiness, but wants to define the conditions for a *just* society. The question of future generations can also be analysed by this approach. Rawls argues that the principle of impartiality between present and future generations is too demanding; there is no reasonable argument for demanding from the present generation that it share the available resources with the *whole* of posterity. But it is quite reasonable to hand on to our *immediate* posterity a better situation than we have ourselves inherited. Rawls writes:

Each generation must not only preserve the gains of culture and civilization, and maintain intact those just institutions that have been established, but it must also put aside in each period of time a suitable amount of real capital accumulation. (Rawls 1972: 285)

The language of economics ('capital accumulation') is a bit technical here but what is meant is simple: each generation has to hand on to the following one technology, investments in science and education, agriculture, etc. Note, however, that the extraction of, say, minerals from the earth is an irreversible act, both as regards the 'loss' of the mineral (in its natural form) and also as regards an eventually aesthetic damage (as would be the case in the destruction of a mountain or a village). In this case all that the present generation can do is hand on a compensation for this loss; this compensation may take the form of improved technology which in turn leads to an increase in productivity which finally leads to higher incomes and/or to a decrease of the

average working day. (By the way, this is how irreversible destruction of natural resources in this century has been legitimated.) However, I think that Rawls's suggestion is misleading, because it overlooks the fact that the interests of the immediate and all future generations may not coincide, as a simple example can show: there may be a technical solution to storing nuclear waste for the next generation (or even the next two or three generations) but this way of storing may become dangerous for the tenth or hundredth generation. Furthermore, Rawls's reasoning does not give criteria to judge the problem of preservation of species.

But how does Marx relate to these approaches? At first sight, none of the outlined approaches contains Marx's position. Marx did not think that any hitherto existing society had, or should have, made sacrifices for posterity. He thought that capitalism anticipated the future in the dreadful way that it wastes human resources:

It is, in fact, only at the greatest waste of individual development that the development of general men is secured in those epochs of history which prelude to a socialist constitution of mankind. (MEGA II. iii. 1. 327, English in original)

Communist society on the contrary, so he thought, would leave the planet to future generations in a better state simply as a result of its pure *modus operandi*. This is not only a matter of prediction and of 'historical laws'; Marx himself expounds it as a duty to unborn generations when he speaks about the duty of the world's inhabitants to hand it down to future generations in a better condition.⁹

From the standpoint of a higher economic form of society, private ownership of the globe by single individuals will appear quite as absurd as private ownership of one man by another. Even a whole society, a nation, or even all simultaneously existing societies together, are not the owners of the globe. They are only its possessors, its usufructuaries, and, like *boni patres familias*, they must hand it down to succeeding generations in an improved condition. (*Capital* iii. 776)

Hence the passage from *Capital* iii does contain a statement about facts (and historical prophecy) and an ethical principle.

⁹ It is thus no ethical argument regarding nature, but an ethical argument regarding human beings (unborn generations).

It is difficult to speculate exactly about what his position amounted to, but a probable answer, taking Passmore's scheme for granted, is that he was committed to both a utilitarian and perfectionist view. Since Marx says 'future generations', a Rawlsian interpretation seems to be excluded. However, we must keep in mind that Marx did not treat this question in a systematic manner, so he probably did not care too much about the formulation.

But Marx also clearly endorsed a perfectionist view. Together with Fichte and Kant, he shared the belief that mankind would always strive towards greater self-realization, towards the ideal society. With the industrialists of his time he shared the belief that the world is imperfect but can be improved. The good society for Marx is a society which enables the release of all human powers, most notably their communal and creative powers (cf. s. 2.5). Since these cannot be defined in advance and once and for all, Marx avoids a static definition of what human needs are or what the communist society would exactly look like; but this much seems clear: communism should be that social form which liberates the human content. This is an open process which finds in a perfectionist view its natural expression. In contrast to Fichte and Kant, Marx offered an account which—so he thought—would explain why mankind moves toward that ideal society. This account is contained in his historical materialism, to which I shall turn in Chapter 4. On the basis of his materialist conception of history, Marx avoided the ethical tone of Kant and Fichte who could only conceive of a duty, a duty to strive for a better future.

Marx's imperative in the above passage where he conceives of a duty of existing generations to leave the planet in an improved situation is rather an exception to his general line of thought. True, in his early writings Marx accepted the categorical imperative to 'overthrow all relations in which man is a debased, enslaved, forsaken, despicable being' (CW iii. 182) but this general principle does not stretch to future generations, once a communist society has been established; it would be sufficient to leave the planet in the same condition and to take care that mankind will not regress to a state in which man again becomes a forsaken and despicable being.

2.1.4. *Unintended consequences and the 'tragedy of the commons'*

As regards unintended consequences, Marx was one of the first social scientists who systematically treated this mechanism. He employed this kind of analysis himself when he demonstrated both on the political and economic level how individual rationality can bring about collectively undesirable outcomes. As Elster put it:

The general idea that unintended consequences arise when agents entertain beliefs about each other that exemplify the fallacy of composition is an extremely powerful one. In my opinion, it is Marx's central contribution to the methodology of social science. (Elster 1985: 48)

Economists are usually interested in positive feedback loops which give rise to their beloved 'invisible hand mechanisms'. But Marx immediately sees the two possibilities contained in this mechanism:

The real point is not that each individual's pursuit of his private interest promotes the totality of private interests, the general interest. One could just as well deduce from this abstract phrase that each individual reciprocally blocks the assertion of the others' interest, so that instead of a general affirmation, this war of all against all produces a general negation. (*Grundrisse* 156)

As Elster rightly observed,

for Marx, counterfinality—the negative externalities of the capitalist mode of production—was a more interesting phenomenon. He believed that capitalism systematically tends to aggravate spontaneously arising crises, since each entrepreneur reacts to them by behaviour that, even if individually rational, is disastrous in the aggregate. The main instance of this mechanism Marx found in the process that according to him tends to generate a fall in the rate of profit. (Elster 1985: 25–6)

Marx employs the same structure of argument with respect to the phenomenon that behind the backs of capitalists a process is at work which, through increasing productivity, reduces socially necessary labour which turns out to lower effective demand. Marx also uses this argument in summarizing the whole capitalist business cycle, i.e. on a meta-level. Here the specific

capitalist means of increasing productivity lead to economic crises. This is one major reason why Marx condemned capitalism: he condemned it as a socially antagonistic form of wealth production. Certainly, capitalism develops the productive forces (this is, according to Marx, its historical legitimization), but it does so by wasting social wealth. Tremendous amounts of *value* are depreciated in periods of economic crisis, and labourers and soil are exploited and degraded during capitalism's 'business as usual'.

Another example of the presence of this mechanism in Marx's work is the 'tragedy of the commons' which I referred to in section 1.3. Marx comes close to recognizing this mechanism when, in a letter to Engels, he praises the German agriculturalist Fraas for proving

that climate and flora changed in historic times . . . He maintains that as a result of cultivation—in proportion to its degree—the 'dampness' so very much beloved by the peasants is lost (hence plants, too, emigrate from South to North) and eventually the formation of steppes begins. The first effect of cultivation is useful but is eventually devastating on account of deforestation etc. . . . The sum total is that cultivation—when it progresses naturally and is not consciously controlled (as a bourgeois, of course, he does not arrive at this)—leaves deserts behind it, Persia, Mesopotamia, etc. Greece. (Letter to Engels, 25 Mar. 1868)

Now this is clearly a different explanation from the one which blames market mechanisms (or capitalism) for ecological problems.

2.2. Marx's motivation for his critique

Fortunately, Marx's approach is far richer in scope than is reflected in the all too well-known standard interpretation which blames only capitalist relations for all evil. Taking Marx in a broader sense seems to me supported by at least two facts. Firstly, Marx's critique of capitalism was no end in itself, but was to serve the establishment of a 'true, human society' (see ch. 5). Marx criticized capitalism mainly because of its 'enslaving effects' on human beings. Enslaving effects can express themselves in many ways; they may take the form of overt or covert

oppression and they may also take the form of *alienation* which Marx thought was the prevailing form in the capitalist system. Alienation, for Marx, presupposes a 'true human' essence which will come into being once the conditions of alienation are removed; thus communism is the realization of the true human essence, of true human society. If we take this line of thought as a guiding thread, we have a far richer approach for our subject than a simple 'capital-criticism' would offer us. Marx criticized the social form of capitalism because it alienated men: the products of their work appear to them as if they were alien powers. In the *German Ideology* he writes thus:

This fixation of social activity, this consolidation of what we ourselves produce into a material power above us, growing out of our control, thwarting our expectations, bringing to naught our calculations, is one of the chief factors in historical development up till now. The social power . . . which arises through the co-operation of different individuals as it is caused by the division of labour, appears to these individuals, since their co-operation is not voluntary but has come about naturally, not as their own united power, but as an alien force existing outside them, of the origin and goal of which they are ignorant, which they thus are no longer able to control, which on the contrary passes through a peculiar series of phases and stages independent of the will and the action of man, nay even being the prime governor of these. (*German Ideology* 47–8)

As Fetscher summarized Marx's concern:

Domination of man over 'social nature' should do away with the quasi-natural forces generated by the capitalist system of production. Thus the 'free association of producers' is at the same time the prolongation and the accomplishment of human history as the humanization of nature and of the appropriation of truly humanized nature by man. (Fetscher 1973: 460)

But it is not only capitalism which brings about alienation; there are other social forms which display this feature; and it seems doubtful to many that alienation can ever be overcome. This is in part due to the character of our complex world of technology and social institutions. If this is so, might not Marx's own approaches give us illuminating insights into this field? If so, much of my task would be fulfilled, namely showing how useful Marx can be in analysing ecological problems. Marx

treats technology as a constituent part of mankind in prominent places throughout his work (see ch. 3). He thus offers an analytical tool for investigating ecological problems.¹⁰ The other tool consists in his social theory which investigates the features of social institutions. As we shall see, Marx focused on this subject as well in the most prominent places throughout his work and, what is more, he combined both aspects in a theoretical framework which has been called 'historical materialism' (see ch. 4).

Now it would be beside the point to blame a writer for having written on problems which were pressing at his time. But, unfortunately, it seems that sometimes contemporary Marxists are unable to acknowledge the changed reality in a profound way (of course, even the most orthodox Marxist will pay lip-service to the fact that reality has changed...) and to build their theory on these changed 'real' preconditions. Moreover, they have blinded us to an approach which is able to deal with contemporary problems (such as ecology) in an illuminating way. Thus I plead for a reinterpretation of Marx in this respect which acknowledges frankly Marx's own predominant approach (i.e. blaming capitalism's social form) but does not accept it as the main tool in analysing contemporary ecological problems. In order to do so, we have to exploit some resources in Marx's thought which have not yet been acknowledged to the extent they deserve. Moreover, as my analysis will show, Marx himself in his preparatory writings for *Capital* analysed machine technology in a way which focused on its inherent characteristics, regardless of the capitalist context in which it was placed. Orthodox Marxism has blinded us to such theoretical possibilities by stressing the paramount role of capitalist exploitation and class rule as causing all major problems in the modern world. Such a narrow and, confronted with the facts, unrealistic interpretation of Marx's thought may have the advantage of being in line with the argument in *Capital*. But in neglecting other most interesting parts of his theory, and overlooking ecological prob-

¹⁰ It is not surprising that he did not consider inherently dangerous technology or high-risk systems. For one reason, he wrote over 100 years ago and could not witness the problems of modern technological systems. For another reason, he seemed to have been quite confident regarding the possibilities of overcoming technical problems which have detrimental effects on human beings. Instead, he insisted that it was the capitalist use of technology which makes life unpleasant and risky.

lems in socialist countries, the orthodox Marxists have done a disservice to Marx's thought, convincing many of their opinion that his theory has little to offer in respect to contemporary problems.

2.3. Three Marxist approaches

In section 2.1 I tried to relate some of Marx's statements to contemporary debates on ecological problems. In what follows, I shall present three approaches which are to be found in Marx's writings, all of which could be related to ecological problems. The first approach blames *capitalist* production (s. 2.3.1), and the second *alienation*, for ecological problems (s. 2.3.2). The third approach is more general in that it investigates natural and social factors without focusing immediately on the capitalist form (s. 2.3.3). I shall claim that this is the most promising approach and I use it as the basis for my own argument.

2.3.1. First approach: capitalist production as a cause of ecological problems

In its concentration upon capitalist profit-maximizers, Marx's approach is fairly close to the 'externalities approach' (see s. 1.3.6) with one difference: Marx's main focus is on capitalists as externalizers. As we have seen in Chapter 1, however, the scope of the phenomenon is much wider: state enterprises and private consumers, too, externalize their costs, following general standards of rationality. The potential of public enterprises for causing ecological problems is as great as that of private enterprises, if they employ high-risk technology. The same holds true for state enterprises in socialist countries. Let us determine, then, the potential of private consumers for damaging the natural environment. Imagine the following possibilities: littering, private cars, and burning. In the case of littering, most civilized countries employ public services to remove refuse. The responsibility lies thus with the state (public organs) which has to provide a solution to the problem (burning waste etc.). Individual citizens pay a fee for obtaining this service. Marx saw the possibility of private pollution but tried to tie it to the capitalist economy, that is, he saw it as being caused by irrational social principles:

Excretions of consumption are of the greatest importance for agriculture. So far as their utilisation is concerned, there is an enormous waste of them *in the capitalist economy*. In London, for instance, they find no better use for the excretion of four and a half million human beings than to contaminate the Thames with it at heavy expense. (*Capital* iii. 101, my emphasis)

Marx assumes that a rational society would find a solution for using excrement as a fertilizer for agriculture. Up to now, however, there is no solution available in this respect. Human excrement is simply not appropriate for fertilizing agricultural land.

A widespread view of environmentalists is that private consumers ought not to buy potentially damaging goods, such as batteries, plastics, cars, etc., in order to abolish this kind of refuse and to allocate the productive capacities of society to other, less damaging, production. This argument forgets the structural aspect of the problem: it forgets the 'embeddedness' of virtually every consumer in a network of social obligations, technological and economic constraints and possibilities, which by and large reproduces the present structure of consumer goods. To be sure, the market mechanism would allow for the replacement of presumably dangerous materials with less dangerous material, if the new material could be produced at competitive prices. But this depends on technological possibilities which are economically profitable. The environmentalist, confronted with such an argument, would probably confess his readiness to pay much more for a certain good, if this would protect the environment. This solution, however, again raises the spectre of the prisoners' dilemma. We can regard it as a solution only under two premisses: (1) that the real income allows for such choices; (2) that the vast majority of people would become what Pizzorno has called 'identifiers'.¹¹ But note, this 'solution' only reformulates our problem: for people to adhere to a 'logic of identity' rather than to a 'logic of utility', they would have to accept some sort of 'green' ideology and enter a 'circle of recognition' which is constituted by other

¹¹ Starting from Hirschmann's notions 'exit, voice and loyalty', Pizzorno introduces a fourth notion: identification. This is supposed to explain behaviour which otherwise could not be explained. See Hirschmann 1970 and Pizzorno 1986.

committed environmentalists. Even opponents of the anthropocentric view partly recognize this embeddedness. Paul Taylor, for example, writes:

We are part of a civilization that can only exist by controlling nature and using its resources. Even those who go out to a natural area to enjoy the 'wilderness experience' are recipients of the benefits of advanced technology. (What marvels of modern chemistry went into the creation of plastics and synthetic fabrics in their backpacks, tents, sleeping bags, and food containers!) None of us can evade the responsibility that comes with our high standard of living; we all take advantage of the amenities of civilized life in pursuing our individual values and interests. (Taylor 1986: 191)

In the case of private cars, at least some countries have introduced technical standards which limit the quantity of toxic gas in car exhaust. In countries where no such legislation exists, the potential for private pollution is considerable. Take now the problem of private burning. Especially in winter time the big cities of many countries are covered by an unbreathable air. A change in this situation is not very likely since every individual consumer seems to prefer breathing bad air to freezing. Even given the existence of a new, clean, heating technology, this attitude of the 'rational consumer' will not change unless special incentives are created which 'force' people to change their heating systems. But in many towns, heating is provided by public services (central heating plants), hence shifting the responsibility again from the individual to the social level.

To sum up, then, two things can be said. Firstly, the situation of private consumers is sometimes characterized by the fact that their environmental responsibilities are taken over by public administration. Secondly, the impact of private consumers on the environment is of much less importance (with the possible exception of private cars) than the impact of the other mechanisms listed in section 1.3. This is so because the scope of private pollution is much more restricted, because the technology at hand is much less powerful. It seems plain that Marx underestimated the externalizing potential of public enterprises (and, to a lesser extent, of private consumers). Marxists after him have been mistaken in underestimating the externalizing potential of socialist enterprises.

In the early *On the Jewish Question* Marx connects the degradation of nature to the dominion of money:

Money is the jealous God of Israel in face of which no other god may exist. Money is the universal self-established value of all things. It has therefore robbed the whole world—both the world of men and nature—of its specific value. . . . The view of nature attained under the dominion of private property and money is a real contempt for and practical debasement of nature. (CW iii. 172)

As we saw above, Marx blames capitalist production for the interruption of the man–nature metabolism: 'on the other hand, [capitalist agriculture] disturbs the circulation of matter [*Stoffwechsel*] between man and the soil i.e. prevents the return to the soil of its elements consumed by man in the form of food and clothing; it therefore violates the conditions necessary to lasting fertility of the soil' (*Capital* i. 474). In the following passages Marx demonstrates how he applies the working of the principles of capitalism to its own life-conditions, the soil and the labourer. Here his explanation is clearly one which rests on the 'unintended consequences mechanism', although Marx himself tries to limit it to the capitalist epoch.

[A]ll progress in capitalistic agriculture is a progress in the art, not only of robbing the labourer, but of robbing the soil; all progress in increasing the fertility of the soil *for a given time*, is a progress towards ruining the lasting sources of that fertility. The more a country starts its development on the foundation of modern industry, like the United States, for example, the more rapid is the process of destruction. Capitalist production, therefore, develops technology, and the combining together of various processes into a social whole, only by sapping the original sources of all wealth—the soil and the labourer. (*Capital* i. 474–5, my emphasis)

In *Capital* ii Marx dedicates some attention to the problem of timber-growing:

The long production-time (which comprises a relatively small period of working time), and the great length of the periods of turnover entailed, make forestry an industry of little attraction to private, and therefore capitalist, enterprise, the latter being essentially private even if the associated capitalist takes the place of the individual capitalist. The development of culture and of industry in general has ever evinced itself in such energetic destruction of forests that everything done by it

conversely for their preservation and restoration appears infinitesimal. (*Capital* ii. 248)

However, as we saw in Chapter 1, the absence of the profit principle, and the absence of market competition, does not ensure a careful use of natural resources. Marx often seemed to take into account this possibility incidentally, without elaborating on it. Rather, it came to him via the reading of Fraas. As Fetscher has observed, Marx was deeply inspired by Fraas, whose book *Klima und Pflanzenwelt in der Zeit: Ein Beitrag zur Geschichte beider* he 'discovered' in 1868 and about which he commented to Engels enthusiastically, as we have seen above (Fetscher 1985a: 124). He appreciated the work of Liebig in the following way: 'To have developed from the point of view of natural science, the negative, i.e. destructive side of modern agriculture, is one of Liebig's immortal merits' (*Capital* i. 475). Therefore, both the problems of fertility and forestry illustrate the mechanism of unintended consequences and the 'tragedy of the commons', rather than capitalist methods. Consider, first, the forestry example. Marx's claim is that forests have been destroyed throughout history, under no matter which form of property. This is to say that not only the market mechanism or capitalist methods of production lead to destruction of forests but also collective forms of growing timber. Consider, now, the fertility example. Here Marx juxtaposes a short-term rationality ('increasing the fertility for a given time') to a long-term irrationality ('ruining the lasting resources of that fertility') where the latter is explained by the former. This interpretation is further supported by Marx's general assertion that 'the development of culture and industry *in general*' (Letter of 25 Mar. 1868) has led to such an energetic destruction of forests.

But let us turn again to the general destruction of soil and labour as a result of the capitalist mode of production. Marx identifies large-scale industry and agriculture as main causes of ecological problems:

Large-scale industry and large-scale mechanised agriculture work together. If originally distinguished by the fact that the former lays waste and destroys principally labour power, hence the natural force of human beings, whereas the latter more directly exhausts the natural validity of the soil, they join hands in the further course of development

in that the industrial system in the country-side also enervates the labourers, and industry and commerce, for their part, supply agriculture with the means of exhausting the soil. (*Capital* iii. 813, amended translation)

With regard to the destruction of labour Marx points to the fact that individual rational behaviour of capitalists leads to disastrous outcomes on the aggregate level:

'Après moi le déluge! is the watchword of every capitalist and of every capitalist nation. Hence capital is reckless of the health or length of life of the labourer, unless under compulsion from society. To the outcry as to the physical and mental degradation, the premature death, the torture of over-work, it answers: ought these to trouble us since they increase our profits? (*Capital* i. 257)

In illustrating what the consequences of capitalist production amount to for the worker, he claims that the introduction of machinery worsens the working conditions for the workers:

At the same time that factory work exhausts the nervous system to the uttermost, it does away with the many-sided play of the muscles, and confiscates every atom of freedom, both in bodily and intellectual activity. The lightening of the labour, even, becomes a sort of torture, since the machine does not free the worker from work, but deprives the work of all interest. (*Capital* i. 398)

Three things spring immediately to mind: (1) Marx partly blames capitalist relations, partly modern industry for the undesirable results; (2) he concentrates far more on the waste of labour than on the waste of the natural environment; (3) the waste of the natural environment in Marx's view is largely limited to the waste of soil as a result of capitalist agriculture. Since I discuss (1) extensively in Chapter 3, only the last two points will be further commented on here. Marx is fairly optimistic regarding the possibilities of recycling. In *Capital* iii he stresses the fact that capital has an interest in consuming the elements of production in an economic way:

The general requirements for the re-employment of these excretions are: large quantities of such waste, such as are available only in large-scale production; improved machinery whereby materials, formerly useless in their prevailing form, are put into a state fit for new production; scientific progress, particularly of chemistry, which reveals the useful properties of such waste. (*Capital* iii. 101)

Regarding the chemical industry Marx is completely optimistic. According to him, it utilizes not only its own waste, for which it finds new uses, but also that of many other industries (*Capital* iii. 102). The general result of Marx's analysis with regard to 'undermining the fountains of wealth' is formulated in the following pointed manner: 'Capitalist production . . . is very economical with the materialized labour incorporated in commodities. Yet, more than any other mode of production, it squanders human lives, or living labour, and not only blood and flesh, but also nerve and brain' (*Capital* iii. 88). In the *Manuscripts 1861-3* he phrases it this way: 'The capitalistic production is . . . most economical of realized labour, labour realized in commodities. *It is a greater spendthrift than any other mode of production of man, of living labour, spendthrift not only of flesh and blood and muscles, but of brains and nerves*' (*MEGA* II. iii. 1. 326-7, original in English, emphasis added).

As we saw above, Marx distinguished between two sources of wealth: soil and labour. That Marx's main interest was in the waste of human beings is not due solely to his humanist standpoint and his political outlook. Undoubtedly it reflects the historical situation of his time where the far more pressing problem was the direct waste of human beings in the production process. Nowadays, human beings are endangered perhaps less within the industrial production process than outside it. Marx was preoccupied with the life-conditions of the working class resulting from overwork and bad working conditions. There was a remedy at hand which in fact improved the working conditions and the lives of the working class and which Marx supported: the labour legislation which led to the shortening of the working day which introduced, *inter alia*, standards of job security. What if we apply this by analogy to the destruction of the natural environment? Imagine two clear-cut cases. The first is a production process in which human beings are wasted, but which, ecologically, does little damage. The second is a production process in which labourers enjoy safe and decent working conditions, a short working time, but which harms the natural environment. If we take these two cases as ideal cases and suppose—for the sake of the argument—that the first obtained during Marx's time, whereas the second obtains today, we

might benefit from an explicit application of Marx's approach to the natural environment.

Excursus on law

Before proceeding any further, we must ask: how exactly does Marx conceive of the exhaustion of labour power? In the opening paragraph of section 5, chapter x, of *Capital* i, he writes:

What is a working-day? What is the length of time during which capital may consume the labour power whose daily value it buys? How far may the working day be extended beyond the working-time necessary for the reproduction of labour power itself? It has been seen that to these questions capital replies: the working-day contains the full 24 hours, with the deduction of the few hours of repose without which labour-power absolutely refuses its services again. (*Capital* i. 252)

Capital does not respect the time necessary for human education, intellectual development, fulfilment of social functions, social intercourse, the free play of physical and psychical life powers. It does not even respect the holy Sabbath (cf. *ibid.*). Following its blind instincts, capital overruns not only the moral, but also the physical, limits of the working day: all the worker's 'disposable time is *by nature and law* labour time' (*ibid.*, my emphasis). If we apply this argument to man's dealing with nature, we would get the following argument: nature belongs to man 'by nature and law' in its entirety; man overruns the 'moral and physical limits' of nature; man often does not permit nature to recover. In fact, Marx himself says that 'a *greedy* farmer snatches increased produce from the soil by robbing it of its fertility' (*ibid.* 253, my emphasis).

As we have seen, Marx invokes moral and physical limits when speaking about the working day and its limits. Does it make sense to do the same with respect to nature? As regards the moral dimension, I think that Marx would have refused. He time and again ridiculed all forms of nature worship and sentimentalism. This becomes clear when we look at his appraisal of capitalism, in so far as it 'creates the bourgeois society, and the universal appropriation of nature' (*Grundrisse* 409).¹²

¹² In a polemic against the 'true socialists' and the nature-cult of Mr Daumer, Marx makes fun of a view which sees essentially harmony in nature, see *CW* v. 471-3; *CW* x. 244-5.

In Chapter I I discussed several versions of the argument that nature prescribes how society should live ('nature knows best'). Interestingly, Marx polemicizes against such a view which was already being put forward by the true socialists:

The true socialist proceeds from the thought that the dichotomy of life and happiness must cease. To prove this thesis he summons the aid of nature presupposing that this dichotomy does not exist in nature and from this he deduces that since man, too, is a natural body and has the properties which bodies generally possess, this dichotomy ought not to exist for him either. (*CW* v. 473)

We can think of nature as having either *instrumental* or *intrinsic* value. As Passmore put it: 'On the first view, wilderness and species ought to be preserved only if, and in so far as, they are useful to man. On the second view, they ought to be preserved even if their continued existence were demonstrably harmful to human interests' (Passmore 1974: 101). He rightly says that 'usefulness need not be narrowly interpreted: wilderness and species, it might be argued, are valuable not only as economic resources, actual and potential, but as providing opportunities for the pursuit of science, for recreation and retreat, as sources of moral and aesthetic delight' (*ibid.* 102; cf. Norton 1987: 12 f.). It thus seems a promising project to develop arguments against the destruction of the natural environment on the basis of its *instrumental* rather than its *intrinsic* values; the more so, since Marx's position connects the aspect of domination of nature to human interests.

Marx, drawing an analogy between exhausted working power and exhausted soil, used an instrumentalist argument in the example of the greedy farmer. Yet another observation can be made about this example. He did not say that the exhaustion of soil was due only to capitalist methods, but that it was due also to the greedy behaviour of the farmer. Of course, as we have seen above (*Capital* i. 474-5; *Capital* iii. 813), Marx thinks that capitalist methods accomplish the destruction of soil in the most systematic and 'efficient' way. But his reference to the 'greediness' of the farmer suggests that it is a fundamental problem that must be faced by every social form. In similar fashion, Marx analyses the labour process in its material content ('as such') before he dedicates his attention to the specific social

forms (above all, the capitalist one; cf. *MEGA* II. iii. 1. 82, as quoted above).

With such an approach one does not say that capitalism exhausts nature just like it exhausts labour power, but that the labour process (sometimes) exhausts nature just like the capitalist exhausts labour power. In both cases the exploiter has to face negative consequences if he is too ruthless. During Marx's time capitalists resolved the problem of a perishing labour force by importing new labour until labour legislation put an end to this. In the case of man's exploitation of nature we can distinguish two cases, recalling the distinction between the 'prisoners' dilemma' and the 'assurance game' in Chapter 1. The point of the PD is the following: If the assurance mechanism does not work, optimal outcomes are only obtained by superior force, that is, when all actors are 'forced' to contribute to the public good either in a direct way (penal law) or in an indirect way (selective incentives). Before considering this possibility, let us look briefly at the possibilities for co-operation. As has been pointed out, the number of actors must be limited and the game must be repeated. Taking a limited number of actors for granted, the repetition of the game does not necessarily give an incentive to contribute to the public good: if an actor is better off by polluting and can off-load the costs on to 'the public', then he will not co-operate. In this case, the future is likely to become the 'junkyard of the present' (*Müllhalde der Gegenwart*) as Preuss (1981) aptly remarked. If, however, the future 'retroacts' even now, and if it can be anticipated in some way, actors may have an incentive to co-operate. But note that it is only in the case of this feedback loop, where detrimental consequences become felt, that a further discounting of the future is likely to be avoided.¹³

Basing the argument on such considerations, then, it seems that there is no mechanism which automatically secures an optimal outcome. Let us therefore discuss an alternative: law coerces actors to co-operate. Can law provide the key to the solution of ecological problems? The existence of an environ-

¹³ As C. Perrow pointed out to me, it is essentially human to act within short time-spans and to consider only short-term consequences of that action. But the present time with its immense and fast information and communication systems may contribute to a change of this state of affairs.

mental law does not in principle alter anything with respect to the behaviour of rational actors; the problem would be restated in the form that it might be rational for the actors to break the law. But let us simply assume that negative incentives (threat of sanctions) are at work which prevent actors from doing so. For the purpose of exposition we may take Dworkin's (1978: 171) distinction between three approaches of modern law: rights-based theories, duty-based theories,¹⁴ and goal-based theories. The first and second are mainly concerned with individual interests; the third concerns the community as a whole (cf. also Waldron 1984: 12–14). In elaborating the first approach, there have been contemporary efforts to extend the concept of rights to animals,¹⁵ to material objects in nature,¹⁶ to artistic creations, and to foetuses.¹⁷

It seems pretty clear that Marx would have scorned rights-based theories. From what we know, he was already opposed even to the rather limited concept of rights in his own time (see his *On the Jewish Question*; see also Campbell 1983 and Lukes 1985 for an evaluation). However, in the case of labour legislation he was in favour of using law as an instrument against capital's assault on workers, which might presuppose the attribution of rights to them. With respect to a duty-based theory, Marx, at least in his early Hegel critique, inspired by Kant's categorical imperative (which is taken as a basis in many contemporary duty-based theories), formulated his own categorical imperative: 'The criticism of religion ends with the teaching that man is the highest being for man, hence with the categorical imperative to overthrow all relations in which man is a debased, enslaved, forsaken, despicable being...' (CW III. 182; cf. *ibid.* 187). As we shall see in the next section on Marx's philosophical anthropology, Marx did in fact endorse some ethical values which he thought to be universally human and which an ideal form of society should put into practice. The problem for him was thus not to attribute rights but to establish the conditions under which man's species power could be released. In Lukes's

¹⁴ Hart (1968: 9) claimed that the duty-based approaches often turn out to be utilitarian, i.e. goal-based.

¹⁵ Regan and Singer 1976; the first attempt was formulated in 1892 by Salt (cf. Passmore 1974: 115).

¹⁶ Stone 1974.

¹⁷ Feinberg 1980.

formulation: Marx opposed the morals of *Recht*, but endorsed the morals of emancipation.

But what about the third possibility of a 'goal-based theory'? This approach, which dates back to Bentham, is essentially based on utilitarian premisses. Since we know how much Marx ridiculed Bentham ('Genie in der bürgerlichen Dummheit') and his 'utility-principle' ('freedom, equality, property and Bentham!') it seems unlikely that he would have allowed his own theory to be characterized in goal-based terms. And yet, there is something there which comes very close to a utilitarian approach. I made the distinction above between nature's instrumental and intrinsic values of nature. Marx adhered to the instrumental view of nature. But what label other than utilitarian (if only in the broadest sense of its meaning) could be given to this approach?¹⁸

Let me return to the question of law. In the previous paragraphs I have dealt with a possible Marxist position regarding law's capacity to deal with ecological problems. The result was not very clear. It seems that Marx could have endorsed all three approaches. Consider, again, his advocacy of labour legislation. At face value his argument is purely goal-based (the working class is the universal class which leads mankind into communism). But since Marx thinks that letting people work to death is simply inhuman, he also endorsed a duty-based theory. And since defending workers' interests seems to presuppose the attribution of rights, he *nolens volens* has to embrace also rights of workers. In what follows I shall concentrate upon the feasibility of the goal-based approach.

For this purpose, I should like to distinguish between law as a medium for regulation and law as a guarantee to secure some minimal standards. Marx, when analysing labour legislation, strongly supported the legal fixation of the limits of the working day. This is an instance where law operates as a guarantee, as a purely defensive mechanism which protects some interests from being overridden. This should be quite uncontroversial among Marxists and liberals (though not among libertarians). However, law as a means for regulation poses some intriguing questions. Recent research suggests that the complexity of many problems makes it extremely difficult for law to achieve

¹⁸ See Lukes 1985 for some similarities between Marx's and utilitarian approaches.

the intended results. This is because law can rarely anticipate the development of science and technology, which would be necessary for it to intervene successfully. Moreover, legal interventions may produce unintended consequences which also harm nature. As Teubner and Willke have pointed out, traditional law was apt to regulate simple, bipolar conflicts (see Teubner and Willke 1984). These conflicts presupposed a world of simple connections. In a stratified society, this condition did in fact obtain (at least to a much greater degree than under modern conditions). Following Luhmann, Teubner and Willke assume that the structural principle of modern societies is no longer stratification or class, but functional differentiation. Modern societies have a high degree of internal complexity which changes the conditions for social development and the possibilities of social regulation in decisive ways (see Teubner and Willke 1984: 9). Law is confronted with a functionally differentiated, complex society; society has no top nor does it have a centre. It follows that it cannot intervene in the traditional way; it cannot 'plan' society. This is not possible, because the social subsystems have gained an autonomy and degree of differentiation which make it impossible for law to bring about only intended consequences. There is the ever-present danger that interventions in one subsystem may have detrimental effects on other subsystems. Hence the slogan 'more law!' may backfire. But neither does the opposite possibility seem feasible, because the mere autonomy of subsystems produces ecological risks and damage.¹⁹ Recently, Teubner has listed four reasons which inhibit regulatory politics. These are (1) Change of goals. Original goals of conditional programmes are changed into a judicial question of 'who loses? who wins?' (2) Statics of legal positions. The means—ends relationship of conditional programmes is transformed into thinking in legal terms. The question now is: Who can trump with rights? (3) Change of reality construction. The reality construction of regulatory programmes, based on certain causal connections, is transformed into a legal reality construction based on a two-

¹⁹ In ch. I, we encountered Merton's statement that there are three main types of unintended consequences: functional, dysfunctional, and irrelevant. Teubner's 'regulatory trilemma' has it that law as a social system may (1) cause dysfunctional effects in other social systems, (2) remain irrelevant, and (3) cause detrimental effects for itself (see Teubner 1985: 311).

party perspective of plaintiff and defendant. (4) Dogmatism. Instruments of regulation are transformed into elements of sheer normative orders and dogmatics (see Teubner 1988c).

Given these difficulties of regulatory policies based on law, the (neo-)liberal comes up with a comparatively simple solution: he assumes that the market leads to beneficial results for nature as well as for society. Marx flirted with such a solution in his analysis of the waste of resources and a possible recycling (see above), and many still regard it as a mechanism which is generally valid.²⁰ One could even say that the waste of resources is not the most urgent problem for modern societies, and this might indeed be due to the working of the market. But Marx was well aware that the working of the market offers no beneficial solution in some cases like agriculture and human labour power. Recalling the discussion in Chapter 1, we can conclude that every naïve reliance on the market is completely fallacious.²¹

Summarizing the discussion of goal-based theories in law, we can say that this approach is linked to the problem of 'steering society' (with all its inherent difficulties). Since a successfully planned society was Marx's final aim, I shall return to this question in Chapter 5.

2.3.2. Second approach: alienation

In section 2.3.1 I concentrated on detrimental effects stemming from capitalist production, especially from its profit principle. I dismissed that principle as too narrow to be able to account for ecological problems. Next, I evaluated the question of private consumers as 'externalizers', that is, as responsible for ecological problems, and arrived at a similar result. Another prominent feature of capitalism which Marx holds responsible for many pathological phenomena of modern society is alienation. Might it not be that under conditions of alienation a careless use of technology and resources takes place which leads to ecological problems? Marx does not elaborate upon this line of thought in a systematic way. However, in *Capital* iii, in the chapter entitled 'Economy in the Use of Constant Capital', he states:

²⁰ See Hayek (1973–9) as the most prominent defender of this position.

²¹ Note that the dogmatic Marxist and the neo-liberal views are symmetrical, but equally mistaken: the one blames the market as one cause of ecological problems, the other praises the market for being the most efficient remedy.

Finally, we have seen earlier that, in fact, the labourer looks at the social nature of his labour, at its combination with the labour of others for a common purpose, as he would at an alien power; the condition of realizing this combination is alien property, whose *dissipation* would be *totally indifferent to him* if he were not compelled to economise with it. The situation is quite different in factories owned by the labourers themselves, as in Rochdale, for instance. (*Capital* iii. 85, my emphasis)

With the idea of being 'compelled', Marx has in mind the institution of piece-work (*Stücklohn*) as the following passage makes clear:

The capitalist's fanatical insistence on economy in means of production is therefore quite understandable. That nothing is lost or wasted and the means of production are consumed only in the manner required by production itself, depends partly on the skill and intelligence of the labourers and partly on the discipline enforced by the capitalist for the combined labour. This discipline will become superfluous under a social system in which the labourers work for their own account, as it has already become practically superfluous in piece-work. (*Capital* iii. 83)

Note that communist society and capitalist piece-work are supposed, here, to be similar in their results: both tend to economize on resources. In both cases, the worker has no interest in wasting resources. The principle of piece-work is said to bring about this result because the worker gets paid for the fruits of his labour according to their quantity and quality. Thus it lies in the worker's interest to produce a maximum output in a certain time period. Capitalists' supervision can therefore be minimized. But here Marx seems to overlook a crucial fact. Since the worker gets paid for the final product, he has no incentive to use resources sparingly. If he squanders resources this need not have negative consequences for his wage. His wage could, however, be related to his use of resources in the following two ways: either the worker has to pay for wasted raw material, semi-products, or damage to the machine (as can easily be done in the case of house work), or supervision and control are maintained. A communist society, therefore, is not free from this problem either (see s. 1.3.5). The possibility of alienation arises as soon as we admit that singular interests are not identical

to general interests,²² a possibility which Marx excluded. I return to this problem in Chapter 5.

2.3.3. *Third approach: man-nature metabolism*

In section 2.3.1, I introduced industry and technology as decisive factors with respect to ecological problems. 'Production' thus seems to be the central category for the analysis of our problem. We are confirmed in this view by a statement from a radical ecologist who said: 'For the sake of nature, no production would be the best production' (Amery 1978: 167, my translation). This position, however, leads to absurdity. Human beings would no longer exist if they stopped producing their life-conditions within nature.²³ Marx's approach is far from such absurdity. He recognizes that human beings are part of nature, the most developed species of animals. They are thus dependent on nature, and have to organize their 'interchange' (*Stoffwechsel*) with nature in order to survive. Furthermore, they employ tools, instruments, knowledge, and skills during their interaction with nature. Let us call this 'technology' for short. He locates technology in the middle between man and nature: it is the necessary condition for man's *Stoffwechsel* with nature; man transforms nature only by using means, tools, technology. According to Marx, 'technology discloses man's mode of dealing with nature' (*Capital* i. 352). The embeddedness of human beings within nature is expressed by Marx through an analogy to organism. He says: 'But just as man requires lungs to breathe with, so he requires something that is work of man's hand, in order to consume physical forces productively' (*Capital* i. 365).

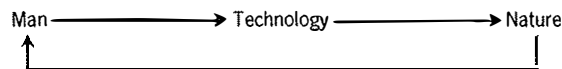


FIG. 2.1

²² A further cause of ecological problems can be called 'technological alienation' and will be discussed in ch. 3.

²³ And yet, even on this level, the argument has been put forward that, if mankind inevitably damages nature in securing its means for life, it would be better that it perish (see Birch 1982: 48–9).

Technology is the mediating instance without which man could not secure his interchange with nature. Marx's approach is essentially based on Hegel:

As soon as he has to produce, man possesses the resolve to use a part of the available natural objects directly as means of labour, and, as Hegel correctly said it, subsumes them under his activity without further process of mediation. (*Grundrisse* 734; cf. *ibid.* 706)²⁴

There are several questions then which need examination before we can address Marx's position in its full scope. The first is the question of nature, to which I turn in the next section (s. 2.4); the second is the question of human nature (s. 2.5). Finally, the question of technology will be addressed in Chapter 3. After this discussion, we will be in a better position to examine Marx's thought with respect to ecological problems; I shall then take up again the threads of nature, technology, and society and discuss them as they are brought together in Marx's historical materialism (ch. 4).

2.4. The concept of nature

In this section I claim that Marx's concept of nature belongs to a discourse which dates back to Pico, Bacon, Descartes, and which includes such thinkers as Hegel and Nietzsche.²⁵ It is this modern view of nature which has structured philosophical reasoning and which has recently come under attack. As we

²⁴ Cf. Hegel: 'Man ought to be proud of his tools since reason is expressed in them. The tool is the *medius terminus* which mediates human activity with outer nature. This is the spirit of reason, in that man preserves himself in turning not himself but something else against nature which is then rubbed off' (Hegel 1983a: 159, my trans.).

²⁵ From Bacon ('nature is a storehouse of matter'), Hegel ('nature has no immanent purpose'), Marx ('nature ceases to be recognized as a power for itself') there is a direct line to Nietzsche ('will to power'). For an exposition of this discourse and its historical emergence, see Leiss 1972. Cf. also Dostoevsky: 'Men will unite to take from life all it can give, but only for joy and happiness in the present world. Man will be lifted up with a spirit of divine Titanic pride and man-god will appear. From hour to hour extending his conquest of nature infinitely by his will and his science, man will feel such lofty joy from hour to hour in doing it that it will make up for all his old dreams of the joys of heaven' (Dostoevsky 1952: 345). But Marx is also different from these writers who propound that man should make an impact on the world: for Marx this goal is related to the goal of controlling all natural and social processes.

shall see, Marx did not merely follow Bacon or Hegel, but developed a quite unique position, however much the 'modern' concept of nature is at its basis. Therefore, in discussing Marx's approach, the whole modern concept of nature is involved.²⁶ A position such as the fundamentalist ecological one which refutes the Marxian position is thus challenging the whole modern discourse of nature. One can regard Marx's position as a test case for the feasibility of the modern discourse on nature. This is all the more interesting since Marx, in my view, has given the concept 'domination of nature' the most compelling formulation. Two things need mentioning here which I take up again later:

1. The concept of domination makes sense for Marx only with respect to interests and needs. Recall the example of King Midas who had the power to turn everything he touched into gold. Now this is clearly a self-defeating power which we would hardly include in a reasonable concept of domination. Likewise, a society which does not take into account the repercussions of its transformation of nature can hardly be said to dominate nature at all. In this version the usual meaning of 'domination of nature' is reversed. In the usual meaning, ecological crises are seen as a result of this very domination of nature. But here they are seen as the absence of it.

2. Marx links the concept of domination of nature to his communist project: for him communism is a state of affairs in which human beings are capable (for the first time) of full self-realization. All naturally evolved natural and social conditions are the products of their *common conscious control*. Communism,

²⁶ Cf. Heidegger 1961: 'That period we call modern . . . is defined by the fact that man becomes the center and measure of all beings. Man is the *subjectum*, that which lies at the bottom of all beings, that is, in modern terms, at the bottom of all objectification and representation' (cited in Habermas 1987a: 133). It is also Heidegger who challenges the modern concept of nature as a 'storehouse of matter and energy' (see Heidegger 1978: 296–9). Modern science, like modern technology, entraps and frames nature. The alternative is to hope that another form of poesis will 'bring forth and reveal': art. Heidegger's vision lies in 'this other possibility: that the frenziedness of technology may entrench itself everywhere to such an extent that someday, throughout everything technological, the essence of technology may come to presence in the coming-to-pass of truth. Because the essence of technology is nothing technological, essential reflection upon technology and decisive confrontation with it must happen in a realm that is, on the one hand, akin to the essence of technology, and on the other, fundamentally different from it. Such a realm is art' (Heidegger 1978: 316–17).

therefore, is the culmination of a process of increasing mastery over nature.

Alfred Schmidt (1971: 29) maintains that Marx employed a double concept of nature. On the one hand nature was for Marx the totality of all existing 'reality' (*Gesamtwirklichkeit*), comprising human beings and 'external' nature, i.e. the universe. On the other hand, nature is only there for human beings if they enter into a practical relationship with it; they are in relation with nature only when transforming it. Marx puts it in the extreme formula: 'But nature too, taken abstractly, for itself—nature fixed in isolation from man—is nothing for man' (CW iii. 345). This passage from the *Paris Manuscripts* indicates that there is no discrepancy between an 'ecologist' young Marx and an 'economist' later Marx.

But, on the other hand, Marx is aware that man can produce nothing without the help of nature (CW iii. 273). In the *Critique of the Gotha Programme* he stresses that labour alone does not create wealth. Here he insists that nature too produces use-values which are the material precondition for all production. However, the *Grundrisse* view that only labour can create *value* (*Grundrisse* 366) is not revoked. Against the physiocrats, Marx holds that it is important to analyse the social forms in which value is produced; value—in contrast to wealth—is not immediately given or transhistorical, it is the economic form which material wealth takes under specific conditions (most typically under capitalism). In other words, the above quote from the *Grundrisse* neither expresses nor implies that Marx disregarded nature in the sense that he undervalued natural preconditions for human production. Quite the contrary is true. However, there is a certain disregard for nature, albeit in a completely different sense. This apparent paradox can be solved by looking at Hegel's distinction between first and second nature. As he put it in the *Philosophy of Right*, para. 4:

The basis of right is, in general, mind; its precise place and point of origin is the will. The will is free, so that freedom is both the substance of right and its goal, while the system of right is the *realm of freedom*²⁷

²⁷ Compare Marx, *Capital* iii. 820, where he refers to the 'realm of freedom'; see also ch. 5.

made actual, the world of mind brought forth out of itself like a second nature. (Hegel 1952, my emphasis)²⁸

Marx takes this outline as a model for a society in which human beings are no longer dominated by alien powers.²⁹ However, Marx disagreed with Hegel on the point of whether existing society, law, and state were manifestations of 'reason'. Marx objected to this Hegelian view for two reasons. Firstly, he maintained that under given circumstances human beings still experience their own creations as alien powers. In this sense history is still to be characterized as pre-history (1859 *Preface*). It follows that second nature is still first nature in the sense that it imposes its blind forces on man in a natural way ('blind wirkende Naturgesetze'). It is intriguing to extricate this line of thought from Marx. As Marx indicated in a footnote in *Capital* i, he agreed with Vico that man can understand the world which is his own product much better than the world of nature (which is, according to Vico, the product of God).³⁰

Does not the history of the productive organs of man, of organs that are the material basis of all social organization, deserve equal attention? And would not such a history be easier to compile, since, as Vico says, human history differs from natural history in this, that we have made the former, but not the latter? (*Capital* i. 352)

Let us call the nature before man's transformation 'nature₁', and the transformed nature 'nature₂'. The latter comprises all products of the human will, all *objectifications*. We can conceive of culture, history, and society as second nature. Now, Marx thought that the more man transforms nature, the more he understands its principles and laws. In this process nature₁

²⁸ In the German original: 'Der Boden des Rechts ist überhaupt das Geistige und seine nähere Stelle und Ausgangspunkt der Wille, welcher frei ist, sodaß die Freiheit seine Substanz und Bestimmung ausmacht und das Rechtssystem das Reich der verwirklichten Freiheit, die Welt des Geistes aus ihm selbst hervorgebracht als eine zweite Natur ist.'

²⁹ Fetscher is right when he emphasizes that Marx's point 'is that men should be able to consciously control their own form of association (division and combination of labour etc.) instead of being dominated by autonomous structural forces. What the free association of producers has to achieve is the completion of the process of humanization that started with the first conscious transformation of nature by men' (Fetscher 1973: 459).

³⁰ As we shall see in ch. 5, Vico's argument needs to be reconsidered.

becomes nature₂. Marx saw the natural sciences as having made great progress in this respect whereas the social realm was still awaiting its revolution. 'Revolution' here is to be taken literally, for Marx thought that a social revolution was necessary to establish nature₂ properly. After the social revolution, therefore, no social science will be needed anymore (sees. 5.5 and 5.6). To repeat: Hegel maintained that the existing forms of nature₂ (law, state, society) were the manifestation of reason; Marx, on the contrary, maintained that, since nature₂ acts upon man in a 'natural' way, in a way which is not understood ('blind wirkende Naturgesetze'), it cannot be the manifestation of man's reason, but only a distorted version of it.

This leads me to Marx's second objection to Hegel. Marx substituted the notion of 'reason' for the notion of man as a 'real human being' who has needs, desires, and consciousness. He derived this line of thought from Feuerbach's critique of Hegel, as the *Paris Manuscripts* show (see s. 2.5). But what is most important here is the implication of this theoretical shift for man's relationship with nature. When I said above that Marx adopts from Hegel his disregard of nature₁, this is not to say that his position is condemned as blind to ecological problems. The introduction of the Feuerbachian 'real sensuous being', as a human *living* organism, reveals the distinction here. Marx conceives of human beings primarily as 'real bodily entities' (which, of course, also have a brain and 'reason') which relate to the rest of nature as their extended body. Marx in his early *Paris Manuscripts* praises Hegel for having conceived of man as producing himself through labour. As he put it, 'the outstanding achievement of Hegel's *Phänomenologie* and of its final outcome . . . is thus first that Hegel conceives the self-creation of man as a process, conceives objectification as loss of the object, as alienation and as transcendence of this alienation, thus grasping the essence of labour and comprehending objective man—true, because real man—as the outcome of man's own labour' (*CW* iii. 332–3, amended translation). This 'greatness' of Hegel, however, did not blind Marx to the fact that this Hegelian being was still an essentially *spiritual* being, a limitation which Marx exposed. But whether we see labour as 'spiritual' or 'practical', it is not the only source of wealth. In 1875, attacking the Programme of the German Social Democratic Party which

declared exactly that 'labour is the source of all wealth and of all civilization', Marx wrote:

Labour is not the source of all wealth. Nature is just as much the source of use values (and it is surely of such that material wealth consists!) as labour, which itself is only the manifestation of a force of nature, human labour power. The above phrase is to be found in all children's primers and is correct in so far as it is implied that labour is performed with the appurtenant subjects and instruments. But a socialist program cannot allow such bourgeois phrases to pass over in silence the conditions that alone give them meaning. (SW iii. 17)

In *Capital* i Marx affirms the same: 'We see, then, that labour is not the only source of material wealth, of use-values produced by labour' (*Capital* i. 50).

To conclude, then, Marx's perspective was that only communist society would merge nature₁ and nature₂, humanizing nature and naturalizing man (to paraphrase a passage from the *Paris Manuscripts*). Thus he writes in the *Grundrisse*: 'Universally developed individuals . . . are no product of nature, but of history' (*Grundrisse* 162). In this transformation process two main factors participate: man and nature. Both have physical properties and limits which must be respected if the transformation process is to be continued. So far, the ecologists' attack on Marx is in vain. But they might now argue that Marxism does not take into consideration these parts of nature which are not needed for material production. As I shall show, this claim is not true either. It would be true if consistent ecological politics required a deontological 'respect for nature' as a starting-point, if the attribution of intrinsic value to nature were the *sine qua non* for ecological concerns. As we have seen, Marx did not attribute an intrinsic, but an instrumental, value to nature. However, it is possible to derive an ecological awareness from such a premiss if we understand the instrumental value as including other elements (such as aesthetic and recreational).³¹ And, what is more, this premiss is more likely to help construct criteria for an ecological position which starts from premisses of

³¹ It may also include a cultural and moral element, as the case of cruelty to animals makes clear. But, as I have argued in ch. 1, this moral standard is derived from *human* needs and purposes.

modern reality and tries to develop an ecological critique on the basis of scientific findings.³²

Still, one might insist that Marx, in privileging second nature, pays too little attention to first nature. Jon Elster called his concept of nature 'extreme and exaggerated' (1985: 56), and 'exaggerated and pointless' (ibid. 57). I agree with him when he claims that Marx's concept of nature does not hold true for 'the millions of solar systems outside the reach of man' (ibid.). But I think Elster himself underestimates the degree to which nature has been transformed by man. Two important points must be made. The first is that we usually underestimate this. Many landscapes, apart from their geomorphological and topographical elements, also contain a cultural element in that they have been created by man—they are 'landscaped'. The most important factor in this process has been the development of agriculture. With agriculture, natural landscapes develop into 'cultivated' ones. Bätzing (1984) has shown how this process transformed the Alps. As Passmore put it: '[T]he landscapes we now so greatly admire—the landscapes of Tuscany or of England or of Kyushu—are largely the creation of human enterprise, of human struggles' (Passmore 1974: 179).³³ The second point is that this is not only a question of degree, of 'how much' nature has been transformed, rather, it is a cognitive point. And here may arise serious problems for Marx. Elster seems not to be aware of the crucial importance of this matter for Marx's whole project; it is not sufficient to call his view extreme and pointless. If Marx is wrong in his exaggerated view, that whole project fails, because this view is one of the corner-stones of a true, human society: from this view derives Marx's optimism, together with the

³² Interestingly, much of the current ecological criticism was suggested by critical scientists. The emerging ecological movement took it up but gave it a (partly) anti-modern direction. One important reason for this seems to be that many environmentalists do not trust the present systems to be able to resolve these problems. On the contrary, they seem to believe that further research and further development of technologies would rather worsen the situation than improve it. However, ecological policy-making also needs concrete technologies which are economically feasible. Ecosystems research is of the utmost importance here.

³³ See also Marx on Feuerbach: '[T]he nature that preceded human history is not by any means the nature in which Feuerbach lives, it is nature which today no longer exists anywhere (except perhaps on a few Australian coral islands of recent origin)' (CW v. 40).

belief that a rational society (human society, communist society) presupposes the *human understanding* of the processes at work (in nature and society). Significantly, Elster himself associates this Marxian viewpoint to Marx's theory of the good society (see Elster 1985: 57), without paying more attention to its cognitive implications. The more human beings have transformed nature₁ into nature₂—so goes Marx's claim—the more they are able to understand the world, the more they are able to avoid 'enslaving effects' which stem from natural or social processes. His concern was to abolish man's (unfounded) beliefs in natural or mystical powers. Taken in this sense, even solar systems (at least those within the reach of telescopes) have been 'transformed' by man without his putting a hand on them; their movements are understood. It was no accident that the phrase 'Copernican revolution' was coined for the new conception of man's position in the cosmos. Similarly, it could be argued that we now know what oxygen is, that is, we know its 'secrets'. In this sense it is transformed, since it represents something other to man than it did before.

2.5. Philosophical anthropology

As Schmidt (1971) has shown, Marx, analysing the man-nature relation, followed a methodological approach which was substantially the same throughout his writings. Its first element is, as we have seen, the double characterization of man as both natural and social being, a definition in which we can detect Feuerbach's influence (man is both 'Natur-Mensch' and 'Menschen-Mensch').³⁴

2.5.1. Man as both a natural and social being

The 'natural' and social dimension are intertwined. When Marx uses the metaphor of nature as man's inorganic body, and refers to this relation as *Stoffwechsel*, the natural dimension is obvious: man as part of nature acts upon nature, just as any other natural element may have an impact on another. In this respect, man is a biological being with physical needs; a being who, like all

³⁴ See Feuerbach 1959, 1960, 1973.

other living beings, can only exist within a natural environment. Marx expressed this view in his early *Paris Manuscripts* with the metaphor of nature being man's 'inorganic body'; in *Capital* he used the language of 'metabolism', or 'interchange with nature' (as the German *Stoffwechsel* is rendered in English). But this *Stoffwechsel* takes place in community with others. Thus human beings are also social beings. As Marx states in the introduction to the *Grundrisse*:

The human being is in the most literal sense, a *zoon politikon*, not merely a gregarious animal, but an animal which can individuate itself only in the midst of society. Production by an isolated individual outside society—a rare exception which may well occur when a civilised person in whom the social forces are already dynamically present, is cast by accident into the wilderness—is as much an absurdity as is the development of language without individuals living together and talking to each other. (*Grundrisse* 84)

Marx stresses this double relation of man to his fellow-men and to nature throughout his work. We shall see in Chapters 3 and 4 that Marx continues this argument and repeats the distinction on the level of society. Here he differentiates between relations of production and productive forces where the former correspond to the relation between 'man and fellow-men', the latter to the relation 'man to nature'. As a result of both their natural (brain) and social character (common goals, tradition of know-how, skills) human beings are able to harness nature, to make it work for them. As Marx remarks in the *Grundrisse*:

Nature becomes purely an object for humankind, purely a matter of utility; ceases to be recognised as a power for itself; and the theoretical discovery of its autonomous laws appears merely as the ruse to subjugate it under human needs, whether as an object of consumption or a means of production. (*Grundrisse* 410, amended translation)

And in *Capital* i:

An instrument of labour is a thing, or a complex of things, which the labourer interposes between himself and the subject of his labour, and which serves as the conductor of his activity. He makes use of the mechanical, physical, and chemical properties of some substances in order to make other substances subservient to his aims. (*Capital* i. 174–5)

In a footnote to this passage Marx refers to Hegel, whom he cites approvingly:

Reason is just as cunning as she is powerful. Her cunning consists principally in her mediating activity, which, by causing objects to act and re-act on each other in accordance with their own nature, in this way, without any interference in the process, carries out reason's intentions. (Cited in *Capital* i; German original in Hegel 1970a: 365)³⁵

The main feature of men is thus not so much that they are tool-making but that they are 'intelligent' in that they can anticipate outcomes of their action upon nature. Human beings are able to project outcomes of natural processes and outcomes of their own work. To illustrate this, Marx compared human activity with that of a spider and a bee:

A spider conducts operations that resemble those of a weaver, and a bee puts to shame many an architect in the construction of her cells. But what distinguishes the worst architect from the best of bees is this, that the architect raises his structure in imagination before he erects it in reality. (*Capital* i. 174)

This projective consciousness is the decisive difference between human beings and animals. Human beings can decide how to build their houses. They do not have a 'natural' place in the ecosystem but they are able to adapt to many environments. Again, as distinct from animals, men do not change their species character in this process of adaptation, but, on the contrary, they exercise it. Human beings have been described as 'Mängelwesen' (Gehlen), beings of shortcomings and deficiencies. 'But', as Fetscher rightly comments, 'man's biological disadvantage is at the same time the basis for his superiority over animals' (Fetscher 1973: 444). Hence Marx's definition fits well with the definition in section 1.2 where the relation between man and nature was defined as: man being (1) in and (2) against (dominating) nature.

³⁵ In his *Naturphilosophie* Hegel makes a more elaborate statement: 'The practical relation to nature is determined by the desire which is egoistic. This desire aims at using nature to our benefit, to rub it off, to cancel it out, in short: to annihilate it . . . The need and the cunning of man has invented many ways of using and mastering nature . . . He takes the means from nature and uses them against her. The cunning of his reason makes sure that he thereby pits natural powers against other natural powers. The former are then attacked and man confirms and preserves himself behind them' (Hegel 1970b: 13 f., my trans.).

2.5.2. Human needs

A decisive feature of man is that he produces and develops his productive capacities. But where does this drive come from? Marx's answer is simple: from human needs. We can derive two sorts of human needs according to my distinction between natural and social characteristics of human beings. As Elster put it:

The concept of human needs is fundamental in Marx's theory of human nature. The good society, for Marx, is one in which people are rich in needs and rich in need satisfaction. Conversely, capitalism is defective both because people have few needs and because the needs they do have are not satisfied. (Elster 1985: 68)

The concept of needs is important also in another sense. We saw that the notion of domination (in general, and in respect to nature) is meaningful only if linked to a notion of interests (for matters of simplicity, I take needs and interests synonymously). Now, how can we establish this link? Elster, drawing on Heller 1976, constructed the following typology of needs in Marx. It includes

1. Physical needs which are needs for physical or biological necessities;
2. Necessary needs which correspond to the conventional and accepted standards of living of a particular group of people at a particular time and place;
3. Luxury needs which are needs which exceed (2);
4. Social needs which are needs which (a) are social in origin, (b) are social in content, or (c) can be satisfied only communally (see Elster 1985: 69).

Obviously, each point in this typology can be related to the ecological problematic in one way or another. To be more specific, I shall qualify the relations in the following way. (1) Physical needs: it is immediately clear that a debased environment may not permit of need satisfaction. This is the case for inhabitants of an extremely polluted area who can no longer have these needs (like food) satisfied in that area. (2) Necessary needs: standard goods of consumption (like water), which have such a low price (if any) that it can be neglected when calculating standard of living, may increase in their prices because it becomes

more and more costly to keep water, for example, clean. As a result, the historical and moral elements which enter this category will change. (3) Luxury goods: it is a cultural and political question to define the distinguishing line between (2) and (3). Some orthodox Marxists and some committed 'workerists' have contended that the perception of environmental problems, as it occurred in the early 1970s, was an expression of the privileged status of the middle and upper classes. Workers, on the contrary (so went the claim), have always faced these problems at their workplaces and tried to improve their situation. In some extreme versions of this 'workerism', it is claimed that workers should not bother about these problems but instead pursue their 'real' class interests. (4) Social needs: Elster gave an example of a social need which can be satisfied only communally: the need for education. Education can be seen as a public good which is usually provided by the state. By analogy, we can apply the logic of collective goods to many ecological problems. Clean air and clean water may serve as examples here. All environmental problems are social in origin in that they are produced socially; to overcome them is both a social concern and a social need.

2.5.3. *Human nature essential to Marx*

To define human beings as communal and creative³⁶ justifies coining the term *theory of human nature*. Man as a 'tool-making animal' can be seen as part of the creative dimension. As Norman Geras, in a most detailed and convincing study, has shown, throughout his writings Marx adhered to something we could describe as 'human nature'. The evidence that Marx held a specific view of human nature seems clear and abundant. And yet, one interpretation of Marx, namely that of Althusser and his followers, has denied precisely this. What is taken as evidence that there was no 'humanistic' element in Marx is the sixth thesis on Feuerbach, the second and third sentences of which read as follows: 'But the essence of man is no abstraction inherent in each single individual. In its reality it is the ensemble of the social relations' (CW v. 4). As regards the exegetical level,

³⁶ For obvious reasons, I take 'creative' here to mean both constructive and destructive. In any case, what counts as constructive or destructive is observer-dependent.

Geras shows that the sixth thesis can by no means be taken as support for the 'anti-humanist' interpretation of Marx (see Geras 1983a: 27–87). With regard to the substantial level, I would like to add the following. When Marx speaks of human nature, and in the sixth thesis apparently denies such human essence, this should be explained in the following way. What the human essence is can only be grasped from its emanations, from its objectifications. This combines the Hegelian idea (that the real is the rational) with the 'positivist' idea that only real, observable entities form the object of scientific investigation. Marx, most explicitly in the *German Ideology*, conceives of human characteristics such as creativity and communality as empirically given facts which can be observed and analysed. Modern industry is a product of this 'inner essence', a thought which had already appeared in the *Paris Manuscripts*. There might be many other human traits which have manifested or which will manifest themselves; what Marx is interested in is the significance of these traits. How does he define what is significant and what is not? According to him, it is the (self-)production of the conditions of human life which leads him to attribute to the development of the productive forces, and the relations of production, a prominent place. Certainly, Marx is equally aware of the importance of language or power but he attributes only a secondary role to them. This is because he takes pains to avoid what we may call 'Don Quixotism', that is, the attempt to bring about something for which the preconditions are missing. Such attempts sometimes look funny, sometimes dreadful, and Marx scorned many of his contemporaries for this reason (most notably the Utopian Socialists). Consider how Marx relates class struggle (power) to the development of the productive forces. According to him, class struggle can only play the role of a midwife, a metaphor which Marx used several times. The analogy is obvious: as in biology, in social life, the objective preconditions must be given in order that a midwife can take up her job. This takes me to another set of arguments.

Up to now we have listed a number of statements on human nature which are *explanatory* in character. Additionally, Marx employs the concept in a *normative* sense. He not only holds that there exists something like a human nature, but, moreover, he qualifies this. The substantial part of his concept of human

nature is contained in his notion of labour as free, creative activity. In the *Paris Manuscripts* he distinguishes men from animals by defining their species character:

Free conscious activity is man's species character . . . The animal is immediately identical with its life-activity . . . Man makes his life-activity itself the object of his will and consciousness . . . Conscious life-activity directly distinguishes man from animal life-activity . . . Admittedly animals also produce. They build themselves nests, dwellings . . . But man in the working up of the objective world . . . duplicates himself not only, as in consciousness, intellectually but also actively, in reality, and therefore he contemplates himself in a world he has created. (CW iii. 275–7)

But human beings are not only creative, but also communal, even in cases where they are not directly co-operating, in actions like composing, writing, thinking. 'The individual is the social being. His manifestations of life—even if they may not appear in the direct form of communal manifestations of life carried out in association with others—are therefore an expression and confirmation of social life' (CW iii. 299). This 'expressivist' notion of labour (Taylor 1975) is present in all stages of Marx's theoretical development. Just as German Idealism saw the formation of spirit as self-consciousness, Marx as a materialist 'praxis-philosopher' sees the formation of human species as self-creation: externalization, objectification, and appropriation are the three aspects of this circle.³⁷ In this context, we have the human labour on one side and the objectified, dead labour on the other. The latter is the crystallized result of man's interchange with nature. 'Dead labour', therefore, is many things: technology, buildings, but also culture, institutions; it is man's second nature.

I now address some questions which arise from Marx's philosophical anthropology. One can relate this theoretical outline to the contemporary debate on liberalism and its communitarian criticisms³⁸ and ask: Where does Marx stand? Obviously, there can

³⁷ Habermas 1987a: 75 ff. There are a number of scholars who interpret Marx as transposing Hegel's model to his anthropocentric approach, replacing 'Spirit' with 'mankind'. Cf. Kolakowski 1978, Habermas 1987a, Theunissen 1978, Benhabib 1986. They all point out that Marx also inherits the fundamental difficulties of that theoretical model.

³⁸ Cf. the discussion on Rawls's (1972) book, especially the contributions by Sandel (1982) and MacIntyre (1984).

be no clear answer to this. On the one hand, it seems as if Marx would align readily with the communitarian critique of liberalism since he saw individuals as socially constituted and aiming at a specific conception of the good. However, I want to draw some attention to the fact that Marx, despite all his criticism of liberalism, is no defender of Neo-Aristotelianism, since he does not envisage an institutionalization of the good life in a good society which is based on *virtues*. Therefore, the Greek model of polis was not an option for communist society as perceived by him. The 'good life' for him is something dynamic which cannot be expressed in citizens' basic virtues. This is so because his idea of human self-realization is a *process* which has basically no end. The ideal society, therefore, marks no endpoint in history but is a society which is forever superseding itself.

Self-realization, then, does not allow for an end-state called 'communism'. For these reasons Marx tries to avoid giving concrete models of communist society. And when he does, he tries to keep open all the possibilities of human self-realization. However, the model of self-realization contains a tautology and a paradox.³⁹ The tautology is that human essence (with its potentiality for self-realization) is what it is (for example: limitless). The paradox is that human essence is what it is not since it is everything (because limitless). But if it is everything, it is void, it is nothing. It is a contradiction in terms to define something without drawing the border around the defined object. Likewise, absolute freedom is a contradiction in terms. One can be free only with regard to something or from something. The process of self-realization is a historical process which up till now has gone through certain stages, and has opened up new possibilities.

Marx seems to have been aware of all this. He modifies his position after the completion of the *Paris Manuscripts*. In the *Theses on Feuerbach* and the *German Ideology* he affirms that what for him is important is not an abstract 'human essence' but concrete, real, existing individuals and their *realized* essence, as we find it in existing culture, i.e. industry, science, art, literature,

³⁹ See Luhmann 1988d for the distinction and its application to social thought and social reality. In a similar way, Ricoeur (1986: 309–10) distinguishes between ideology and Utopia; ideology justifies existing relations whereas Utopia contains fictional power.

etc. He thus (1) analyses concrete objectifications of human essence and (2) measures them by an abstract human potentiality. The first operation is based on tautology, the second on paradox. This shows that the model of self-realization as a basis for criticism does not vanish. It may be appropriate to describe Marx's move as a move which de-paradoxified the abstract philosophical thesis of self-realization. He introduces a distinction between historical analysis and critical evaluation—a move which allows him to overcome the void and sterile 'man is everything' and its tautological or paradoxical implications. The distinction separates the analysis of concrete objectifications of human essence (e.g. as realized in productive forces) from the evaluation of these. Historical analysis and critical judgement are thus two distinct operations. To be sure, Marx uses criteria which derive from self-realization when criticizing existing productive forces and social institutions. However, they are 'reintroduced' only after the crucial distinction is made and only after the historical analysis is carried out. The motive of his criticism is the concern for human dignity.

For a better understanding of the following I briefly recall the structure of the argument. According to the *Stoffwechsel* model man transforms nature by means of labour and technology. In Chapter 3 following (and in ch. 4) I therefore focus on the analysis of technology and society, postponing the notion of labour and its implications to Chapter 5.

3 Technology

It is not the articles made, but how they are made, and by what instruments, that enables us to distinguish different economic epochs. (Karl Marx, *Capital*)

So far I have discussed the concept of nature and human nature in Marx and some implications for the ecological problematic. Now I turn to the topic of technology. Apart from the importance this subject has for my discussion of Marx, it additionally provides the opportunity to investigate a subject which has been largely neglected by political and social theory as well as by philosophy.

For the sake of conceptual clarity, the following remarks are in order. The English notion 'technology' is equivalent to the German 'Technik' which derives from Greek 'techné' and means intentional, goal-directed change of things. The *International Encyclopedia of the Social Sciences* gives a useful definition:

[In] its broad meaning it connotes the practical arts. These arts range from hunting, fishing, gathering, agriculture, animal husbandry, and mining through manufacturing, construction, transportation, provision of food, power, heat, light, etc., to means of communication, medicine and military technology. Technologies are bodies of skills, knowledge, and procedures for making, using, and doing useful things. (Merrill 1968: 576)

In order to identify these 'useful things' more precisely, Merrill adds that the concept of technology 'centers on processes that are primarily biological and physical rather than on psychological or social processes' (ibid. 577). Note that with this narrow definition not just any means—ends relationship counts as technology; rather, it stresses means—ends relationships which take place on a 'material' level. It is easy to see how the narrow

definition of technology corresponds to Marx's concept, which also stresses the material aspect.¹

In section 3.1 I shall discuss Marx's approach to modern industry.² Here, I am especially interested in his definition of machinery and his evolutionary view of technology. Several contemporary attempts at conceiving technology in an evolutionary way will be discussed in section 3.2. Closely connected to this problem is the problem of distinguishing between science and technology. I then discuss two theoretical possibilities which are contained in Marx's general position. The first is technological determinism, which I address in section 3.3; the second is technological alienation, which I address in section 3.5. Closely connected to the question of technological determinism and to an evolutionary view of technology is the question whether technology can be conceived as having an 'inner logic' or 'autonomy'. I shall address this problem in sections 3.2 and 3.4, discussing some contemporary approaches. Section 3.5 will discuss the concept of division of labour in Marx.

It has been claimed by several authors that Marx employs a theoretical model which conceives the results of human action as becoming independent from their producers (a process called objectification) but eventually reappropriated. In cases where this reappropriation is not possible but where the objectifications are retroacting upon the producers in a detrimental way, we have a state of *alienation*.³ If such a 'lack of control' can be discerned in the working of technology, if modern technology operates behind the backs of the individuals, then we would have an exact parallel on the technological level to what Marx analysed regarding economics.⁴ Moreover, as can be shown,

¹ For two usages of a wide notion of technology, see Weber 1978: 32f. and Heidegger, who stresses that *technê* is not only the name 'for the activities and skills of the craftsman, but also for the arts and for the fine arts' (Heidegger 1978: 294).

² The German *Große Industrie* has been translated as 'modern industry' as well as 'large-scale industry'. I shall use the former since the text which was at my disposal adopted this translation. The decisive differences between the epoch of *Große Industrie* and other epochs (such as manufacture) are the important thing.

³ See Plemenatz 1975 and Elster 1985 for a distinction between spiritual and social alienation.

⁴ Schelsky spoke of a 'new self-estrangement of man which came into the world with the new scientific civilization. The danger that the creator is losing

Marx himself sometimes suggested such a parallel but did not subsequently develop it. That he could not adhere to such a position will be made clear as well: if there was something in the human condition (technology) which escaped successful social control, his project of liberating society from 'alien powers' would have failed.

3.1. Marx as a student of technology

As Rosenberg (1982a) emphasized, Marx was a careful student of technology. He argues that

quite independently of whether Marx was right or wrong in his characterization of the future course of technological change and its social and economic ramifications, his formulation of the problem still deserves to be a starting-point for any serious investigation of technology and its ramifications. (Rosenberg 1982a: 34)⁵

According to Rosenberg, Marx 'devoted much time and effort to explicating the distinctive characteristics of technologies, and to attempting to unravel and examine the inner logic of individual technologies' (Rosenberg 1982a: 34). Furthermore, 'he insisted that technologies constitute an interesting subject, not only to technologists but to students of society and social pathology as well, and he was very explicit in the introduction of technological variables into his arguments' (ibid.).

But why was Marx so obsessed by the feature of technology to the extent that he focused on it in all his major theoretical works? I think that any answer has to consider at least two elements. First, Marx sees technology as part of the human condition, as the means by which man exercises and regulates his *Stoffwechsel* with nature. Second, Marx was aware of the importance of the productive forces for the development of a mode of production, for the evolution of relations of production,

himself in his work, the constructor losing himself in his construction, is now the metaphysical temptation of man. Man shrinks back from transferring himself without remainder into self-produced objectivity, into a constructed being, and yet works unceasingly at the continuation of the process of scientific-technical self-objectification' (Schelsky 1961, as quoted in Habermas 1976b: 126).

⁵ The history of technology is indeed a very young discipline. See Hughes 1979 for an overview of emerging themes in this discipline.

and, specifically, he was interested in the role of machines and machinery for the emergence of capitalism; likewise, he was interested in the technological basis of communist society. In what follows, I shall turn to each of the two topics.

3.1.1. *Technology as part of the human condition*

It was Marx's firm conviction that modern industry reveals man's active relationship with nature. To be sure, there has been an original state in which 'the free gifts of nature [were] abundant' (*Grundrisse* 612) and hence there was no need to develop technologies. This state is, according to Marx, a pre-historical one. But as soon as human beings develop technologies they begin to have a history. Thus we are able to reconstruct main characteristics of earlier societies by examining the different ways in which production took place. As Marx states:

Relics of bygone instruments of labour possess the same importance for the investigation of extinct economical forms of society as do fossil bones for the determination of extinct species of animals. It is not the articles made, but how they are made, and by what instruments, that enables us to distinguish different economical epochs. Instruments of labour not only supply a standard of the degree of development to which human labour has attained, but they are also indicators of the social conditions under which that labour is carried on. (*Capital* i. 175–6)

In the *Poverty of Philosophy*, Marx bases his judgement on the works of Babbage and Ure who analysed technology and, particularly, machinery. The definition which he adopts is the following:

The machine is a uniting of the instruments of labour, and by no means a combination of different operations for the worker himself... Simple tools; accumulation of tools; composite tools; setting in motion of a composite tool by a single hand engine, by man; setting in motion of these instruments by natural forces; machines; system of machines having one motor; system of machines having an automatic motor—this is the progress of machinery. (*CW* vi. 186–7)

In this definition an interesting evolutionary logic is suggested. Are these evolutionary stages of technology to be explained from within their own development or are they determined by outside factors? Rosenberg (1982a: 34), while suggesting that

Marx assumed an 'inner logic' of technology, simultaneously rejected any technological determinism in his thought. This section will focus on the problem.

When Marx explicates the concept of *Stoffwechsel*, he remarks:

Technology discloses man's mode of dealing with nature, the process of production by which he sustains his life, and thereby also lays bare the mode of formation of his social relations, and of the mental conceptions that flow from them. (*Capital* i. 352)

But just as man requires lungs to breathe with, so he requires something that is work of man's hand, in order to consume physical forces productively. (*Capital* i. 365)

In historical development all three factors involved in this *Stoffwechsel* process are changing: human beings, technology, and nature. Marx aims at an identification of a 'driving force', a mechanism which sets the change in motion. My claim is that Marx approaches this problem in two different ways. One way is to examine history and to draw conclusions. This is essentially an explanatory task. The other way is to evaluate the development of the three factors; this is essentially a normative enterprise. In order to distinguish these two aspects, I use the terms 'historical' and 'critical'.

Taking the *historical* approach to the problem we can conclude that Marx conceived in principle all three factors as 'driving force':

1. nature: geographical determinism;⁶
2. technology: autonomous development, inner logic, evolution;
3. human beings: their needs, developing technologies, transforming nature.⁷

Thus the circle can be started from all three points.⁸

⁶ We find an instance of geographical determinism in a passage (crossed out by Marx) from the *German Ideology*: 'These conditions [geological, or hydrographical, climatic] determine not only the original, spontaneous organisation of men, especially racial differences, but also the entire further development, or lack of development, of men up to the present time' (*CW* v. 31). See also *Manuscripts 1861–3* where he states that geographical and climatic factors determine the differences in the natural tools ('in den natürlich vorgefundenen Arbeitsinstrumenten') which in turn divide the branches of existence of different tribes (cf. *MEGA* II. iii. 1. 266–7).

⁷ Boserup (1981) argues that population and technology stimulate each other through history. Since the ratio man–land is a decreasing one, human beings

Turning to the *critical* dimension, Marx's theoretical humanism immediately springs to mind. Because the good society for Marx is a society in which no alien powers exercise any 'enslaving effects' on the individuals, but, quite the contrary, in which individuals are fully developed and autonomous, an autonomy of (1) or (2) could cause difficulties for his theory. In his view, a society cannot be called free as long as enslaving effects are exercised, no matter whether they come from nature or technology. If technologies are detrimental to human well-being, they must not enjoy autonomy in his theoretical framework. With respect to nature Marx in the *German Ideology* clearly states that a society which lives in an untransformed nature can only be called narrow-minded or ignorant (*borniert*): 'Here, as everywhere, the identity of nature and man also appears in such a way that the restricted attitude of men to nature determines their restricted relation to one another, and their restricted attitude to one another determines men's restricted relation to nature, *exactly because nature has not yet been historically modified*' (CW v. 44; emphasized part missing from the English edition, cf. MEW iii. 31). With respect to technology Marx makes clear that labour must reappropriate the objectified productive forces 'not only to achieve self-activity, but . . . to safeguard their very existence':

[T]he productive forces appear as a world for themselves, quite independent of and divorced from the individuals, alongside the individuals, the reason for this is that the individuals, whose forces they are, exist split up and in opposition to one another, whilst, on the other hand, these forces are only real forces in the intercourse and association of these individuals. Thus . . . we have a totality of productive forces, which have, as it were, taken on a material form and are for the individuals themselves no longer the forces of the individuals but of private property, and hence of the individuals only in so far as they are

develop more productive technologies in order to maintain (or improve) their situation. Note that Marx also sees the possibility that population growth can be a productive force, see *Grundrisse* 400, 528–9, 749.

⁸ The determining role of nature may be limited to an original state where production and society start 'from scratch' (see last footnote). For industrially developed societies we could thus neglect the point. Ironically, however, it comes in again through the back door, when 'careless' use of technology and natural resources has led to a debasement of the natural environment, which in turn affects human well-being and requires measures (often new technologies) to improve the situation.

owners of private property. Never, in any earlier period, have the productive forces taken on a form so indifferent to the intercourse of individuals *as* individuals, because their intercourse itself was still a restricted one. (CW v. 86–7)

The only instance which legitimately enjoys autonomy is the fully developed individual. True, Marx always acknowledges the eternal condition of mankind to produce and reproduce itself within natural limits ('realm of necessity'). Exactly because such limits do exist, so he concludes, the realm of necessity will never vanish completely (cf. *Capital* iii. 820). But he thinks that alienation, also in the field of necessity (i.e. transformation of nature), can be superseded.⁹ Here I want to stress that the *German Ideology* can be read in exactly the same way. Marx conceives of the reappropriation of the productive forces as synonymous with the development of individual capacities. Since the productive forces have developed to a totality,

this appropriation must have a universal character corresponding to the productive forces and the intercourse. The appropriation of these forces is itself nothing more than the development of the individual capacities corresponding to the material instruments of production. (CW v. 87)

The discussion in this chapter, and in the following section 3.1.2, concentrates on Marx's discussion of technological evolution, which seems a challenging enterprise, for it seems that a tension in his theory arises exactly here: a tension between his historical and critical analysis. As I shall show, this tension takes the form of an opposition between a technological evolution and his humanist claims. As Rottleuthner, in another context, puts it:

The concepts of organism and development are linked by their ambivalent and therefore broad political applicability. Development can easily be linked with dynamism and progress, with directions and goals of development, which recall the ideals of perfectibility of the 18th century. But 'development' was also linked . . . with the aspect of objectivity, a context which was remote from the deliberate, goal-

⁹ This foreshadows my discussion in ch. 5 where I give an interpretation of the famous passage from *Capital* iii which diverges from the standard interpretation.

directed action of men. The forces or regularities of development act inevitably. History cannot be made. (Rottleuthner 1988: 110–11)

In the present chapter, I limit the analysis to the question whether technology evolves; in the next chapter, I embark on the question whether technology is autonomous.

3.1.2. *Evolution and technological evolution*

The major source in studying this subject is the recently published manuscript *Zur Kritik der Politischen Ökonomie: Manuskript 1861–63* (*Manuscripts 1861–3* for short)¹⁰ where Marx presents, over hundreds of pages, major contributions on technology. Already a superficial glance into the table of contents shows the importance which Marx attributed to this subject. In part II, volume iii. 1, we find under the heading 'Der relative Mehrwert' excerpts and discussions on co-operation, division of labour, and machinery. In volume iii. 6, Marx returns to the same questions. Just to show how closely Marx did study matters of technology, I shall draw to a great extent on passages from this work (apart from more common sources) which has only recently been published (in German).

Marx conceives the development of the productive forces, and of relations of production, in an evolutionary perspective. He refuses a viewpoint which would treat the individual inventor as the focus of attention. Indeed, in the beginning of the chapter on 'Machinery and Modern Industry' in the first volume of *Capital*, Marx writes:

A critical history of technology would show how little any of the inventions of the 18th century are the work of a single individual. Hitherto there is no such book. Darwin has interested us in the history of Nature's technology, i.e. in the formations of the organs of the plants and animals, which organs serve as instruments of production for sustaining life. Does not the history of the productive organs of man, of organs that are the material basis of all social organization, deserve equal attention? (*Capital* i. 352 n.)

¹⁰ In fact, parts of these manuscripts had been published 1905–10 under the title *Theorien über den Mehrwert*, ed. Karl Kautsky, and 1954–61 by the Institute for Marxism-Leninism at the Central Committee of the CPSU. These editions consisted mainly of notebooks v–xv and xx–xxiii; the new edition of the *Marx-Engels Gesamtausgabe* contains all the notebooks.

A hundred years later this question has still not received the attention it deserves. As Rosenberg rightly observes, this passage from *Capital*, 'amazingly fresh over a century later, reads like a prolegomenon to a history of technology that still remains to be written' (Rosenberg 1982a: 40).

The reference to Darwin comes out even more clearly in the *Manuscripts 1861–3*. Marx explicitly refers to *On the Origin of Species* where Darwin distinguishes between the lower and higher forms of organization of living beings. The criterion for drawing this distinction is the differentiation of organs. Since Marx gives a summary of the passage in German, let me reproduce the English original here. Darwin writes:

I presume that lowness in this case means that the several parts of the organization have been but little specialised for particular functions; and as long as the same part has to perform diversified work, we can perhaps see why it should remain variable, that is, why natural selection should have preserved or rejected each little deviation of form less carefully than when the part has to serve for one special purpose alone. In the same way that a knife which has to cut all sorts of things may be of almost any shape; whilst a tool for some particular object had better be of some particular shape. Natural selection, it should never be forgotten, can act on each part of each being, solely through and for the advantage of each being. (Darwin 1971: 141)¹¹

Marx is inspired directly by Darwin and uses an analogy between biology and technology.¹² He transposes this distinction to technology in the broad sense (including division of labour, tools, machinery, etc.).

The differentiation, specialization and simplification of tools in manufacture, which is based on the division of labour—their exclusive adaptation to very simple operations—is one of the technological, material preconditions for the development of machinery as an element

¹¹ It should be mentioned that Darwin rejected the common equation of evolution with progress (Gould 1973: 36).

¹² It is most interesting that Darwin intuitively conceived of the development of tools and of organs in the same evolutionary way. The Marx/Darwin relation has been a controversial topic. This seems to be due to Marx's ambivalent attitude towards Darwin, see Groh 1981, Avineri 1968, Gerrata 1973, Ball 1979. Marx fiercely rejects the formula 'struggle for life' which is a basic theme of Malthus. In a letter to Kugelmann, Marx stresses that this formula is a mere *Phrase* which is as void (and false) as Malthus's law of (over-)population. See Marx to Kugelmann, 27 June 1870. In a letter to Lassalle, he praises Darwin for having destroyed teleology in the natural sciences (see letter of 16 Jan. 1861).

which revolutionizes the mode and relations of production. (*MEGA* II. iii. 6. 1914)

Marx was convinced that the historical development of technology which is man's organic nature (see s. 3.1.1) cannot be explained by individual behaviour (inventions). Rather, it needs to be explained by an approach which conceives the development of technology from an observer's standpoint, i.e. as *evolution*.¹³ As Weick put it:

What occurs is simply that an observer watches events happen, imposes on these happenings some preconception about order, and this preconception then allows the observer to watch the changing instances, compare them, and see whether there is a progression toward orderliness in those portions being observed. If there is, evolution has occurred. (Weick 1979: 119)

In the above passage Marx alludes to the mechanism of 'adaptation' which makes us ask: does it make sense to suggest similarities between the adaptation of a biological species to an environment and a technology which adapts to 'very simple operations'? Are we not led astray by Marx's application of Darwin's criteria to technology? Darwin suggests that evolution is a process of natural selection which operates by means of variation. The 'goal' of evolution, however, is not variation (nor is it selection or inheritance). These are only the means to secure the survival of the species and to reach an increase in reproductive capacity of the species.¹⁴ This is not to say that the suggested similarities are devoid of heuristic value. Weick pointed out that 'a surprisingly rich introduction to theories of evolution can be obtained with a simple deck of playing cards. If the deck is shuffled repeatedly, it is clear that there is continual change as the cards become rearranged, but does the deck evolve? It all depends. Some people are willing to accept any rearrangement of parts as evolution, whereas others would say that some order must occur out of chaos before it can be said that evolution is occurring' (Weick 1979: 119). Technology and the deck of cards

¹³ 'A critical history of technology would show how little any of the inventions of the 18th century are the work of a single individual' (*Capital* I. 352 n.).

¹⁴ According to Gould, we may distinguish between two main strategies for enhancing reproductive capacity: *r*- and *K*-strategies. The former are directly maximizing reproduction, the latter are adapting ('fine-tuning') to the environment. See Gould 1973: 94.

are similar in that they do nothing by themselves: technology needs to be designed and produced, a deck of cards needs to be shuffled.

There are two main objections to an evolutionary approach within social theory. The first contends that the natural and the social world are different in that the social world is characterized by intentional human action. The second rejects the use of biological models in the social sciences in a more principled way. I comment on both objections in turn.

1. It is true that evolution in the biological and evolution in the socio-cultural (including technological) sphere are distinct. The most important difference is that the latter does not depend on the selection of mutations, since the possibility of new combinations is given in each generation (cf. Luhmann 1984a: 589). This leads to an enormous acceleration of evolution. As Enzo Tiezzi wrote in his instructive *Tempi storici, tempi biologici*:

With biological time we measure biological evolution. Its unit of measure lies in the order of millions of years: thousands of millions of years separate us from the origin of the earth, hundreds of millions of years from the appearance of algae, bacteria, trilobites, Arthropoda, fish, three million years from the appearance of human beings. However, with biological time we also have to measure the future and it is here that the rupture of biological balances induces variations on a planetary level in time-spans so short as to accelerate the geological clock. Transformations which in former times occurred in millions of years can now occur . . . in some decades and the subsequent variations for human and social balances correspond to an acceleration of millions of years of history. (Tiezzi 1984: 62, my translation)

Biological and socio-cultural evolution are thus taking place at different speeds and different rhythms which may lead to ecological problems. It may occur that the fast evolution of society does not permit for an adaptation of some biological species (either of the *K*- or *r*- type). To the extent that social evolution depends on these species, it in turn will be endangered.

Unlike Elster, and others, I do not see the decisive difference between biological and social evolution as resting on the latter being characterized by intentional human action. The decisive difference is that the social realm evolves at a much faster rate than the biological realm. Also, Terence Ball juxtaposes natural and social evolution: 'The opening chapter of his *Origin*

notwithstanding, Darwin fails to see that conscious human selection is, when weighted on the scales of human history, vastly more significant a factor in evolution than is natural selection through chance and accident. Because of human attempts to transform nature, "natural history" is fast becoming "human history". Human purpose and praxis are replacing chance and accident as the motive force of evolution' (Ball 1979: 473). But Ball is doubly mistaken. First he neglects the fact that for Marx capitalist societies cannot be called human societies since they still belong to what he called 'natural history' (see 1859 *Preface*).¹⁵ Second, following directly from the first point, he does not interpret the decisive difference between natural and social evolution as in the first place a difference in relative speeds of evolution, but a difference marked by intentional action which, according to him, replace chance and accident. To repeat: at least for Marx such a state of affairs could be established only in communism (the truly human society), and not in pre-communist societies.

Ball concludes that the 'Marx-Darwin-myth' was completely unfounded. However, there is something which does not fit into Ball's account and which makes understandable a claim like Feuer's, namely that Marxism rests on Darwinian evolution (cited in Ball 1979: 479–80): Marx, while clearly seeing the differences between natural and social evolution and amusing himself about Darwin's identification of nature with the free-market categories of capitalism, nevertheless tries to develop his own theory of social evolution. In this respect Engels's speech at Marx's graveside (where he called him the Darwin of the social world) was not without justification. As Luhmann rightly pointed out:

Darwin's theory of evolution represents a radical break with all earlier traditions of thinking about development and perfection, of history and order. It is no longer an intelligent cause, no longer God's design, but simply a difference that makes the difference. All 'grand theory' of the

¹⁵ Karl Korsch (1967) rightly emphasized that the crucial point for Marx was the overcoming of the *naturwüchsige* traits of society. This word cannot be translated adequately into English with only one word. Marx uses it in a pejorative sense here; it means that people are confronting society as something they do not understand or can do nothing about. I shall translate it with the English word 'natural'.

19th century uses this scheme of thought. So did Hegel, and, of course, Marx. (Luhmann 1984c: 61)

There are various thinkers who have tried to adapt an evolutionary model to the social sciences, among them Donald Campbell. He tried to summarize the main mechanisms of evolution in the following way:

For an evolutionary process to take place there need to be variations (as by mutation, trial, etc.), stable aspects of the environment differentially selecting among such variations and a retention-propagation system rigidly holding on to the selected variations. The variation and the retention aspects are inherently at odds. Every new mutation represents a failure of reproduction of a prior selected form. Too high a mutation rate jeopardizes the preservation of already achieved adaptations. There arise in evolutionary systems, therefore, mechanisms for curbing the variation rate. The more elaborate the achieved adaptation, the more likely are mutations to be deleterious, and therefore the stronger the inhibitions on mutation. For this reason we may expect to find great strength in the preservation and propagation systems, which will lead to a perpetuation of once-adaptive traits long after environmental shifts have removed their adaptedness. (Campbell 1965: 306–7)

Several authors have transposed this model to socio-cultural evolution. As Luhmann pointed out, 'Despite all these differences between organic and socio-cultural evolution . . . the latter is also evolution in the strict sense, that is, an unplanned arrangement of a highly improbable complexity' (Luhmann 1984a: 590, my translation). Note that Luhmann defines evolution (both in the biological and in the socio-cultural sense) as leading to an increase in complexity (see also Ballmer and von Weizsäcker 1974). This complexity is the result of selections of individual ('improbable') variations (mutations) and thus an improbable event. Evolutionary theory, then, would have the task of explaining how it came about that (both in the natural and social world) highly improbable constellations were selected and stabilized.¹⁶ Habermas also tried out possible uses which can be

¹⁶ See also Gould's stress on the important role played by increasing complexity: 'Either plants or animals. Our basic conception of life's diversity is based upon this division. Yet it represents little more than a prejudice spawned by our status as large, terrestrial animals' (Gould 1973: 113). Gould then adopts the five-kingdom typology of Whittaker 'because it tells a sensible story about organic diversity. It arranges life in three levels of increasing complexity . . .

made of evolutionary models in the social sciences. Although it is very tentative, his article is worth mentioning here. He asks what sense it makes to transfer such categories as 'variation' and 'increase in complexity' to society. As to the latter he rightly comments that 'increase in complexity' is no sufficient criterion for establishing an evolutionary hierarchy if we do not know the inner logic of the organisms (Habermas 1976a: 190). Habermas sees the increasing 'learning potential' of societies more as the driving force of development. However, as Gould has convincingly pointed out, we can derive these criteria by looking at how organisms succeed in handling the balance between size and shape (see Gould 1973). By analogy, if we dissect society in social subsystems, we can formulate the criterion that each subsystem must be able to secure its own maintenance, given its level of complexity and its operating codes. The 'goal', so to speak, of its operations thus lies, similarly to natural processes, in securing the continuation of its own operations.¹⁷

2. One might wish to reject the use of biological analogies in a more rigorous way. Indeed, it is common in the social sciences to be highly sceptical of models of theories which are imported from biology.¹⁸ Biological analogies and metaphors are to be found also in Marx.¹⁹ I shall thus make a general remark about analogies as such and about biological analogies in Marx and my own study.

[E]volutionary transition from any level to the next occurs more than once; the advantages of increased complexity are so great that many independent lines converge upon the few possible solutions. The members of each kingdom are united by common structure, not by common descent' (Gould 1973: 117).

¹⁷ At the time Habermas wrote his article, Luhmann had not yet taken his 'autopoietic turn'. But Habermas already objected to 'hopeless circles of self-referential definitions' in Luhmann's and Dunn's efforts in establishing criteria analogous to the survival criterion in biology.

¹⁸ Needless to say, I share this scepticism regarding sociobiology and social Darwinism. For a critique, see Gould 1973 and Hofstadter 1944.

¹⁹ See the afterword to the 2nd edn. of *Das Kapital*, where Marx cites with approval a Russian reviewer of his book who pointed out that it was Marx's method to examine the evolution of social and economic forms, 'in a word, economic life offers us a phenomenon analogous to the history of evolution in other branches of biology. The old economists misunderstood the nature of economic laws when they likened them to the laws of physics and chemistry. A more thorough analysis . . . shows that social organisms differ among themselves as fundamentally as plants or animals' (*Capital* i. 28). Marx comments that this generous review portrays nothing other than his dialectical method.

Gregory Bateson once remarked that it is a feature of the human brain to think with the help of what he called 'abductions'. This is to say that our perception is guided by specific experiences and concepts. If we encounter something new, we try to explain it with common or known ('old') categories, models, or theories.

This lateral extension of abstract components of description is called *abduction* . . . Every abduction may be seen as a double or multiple description of some object or event or sequence . . . In each case, it is assumed that certain formal characteristics of one component will be mirrored in the other. (Bateson 1979: ch. 5)

As to the second point, it has been noted by several authors that Marx deliberately tried to develop his theory with analogy to the natural sciences. Alfred Schmidt has already pointed out that in Marx we find 'peculiarly biological metaphors' in describing man's relationship to nature (Schmidt 1971: 80). Schmidt cites Moleschott and Liebig who both employed the term *Stoffwechsel* which Marx acquired from them. Moleschott wrote that the soul of the world consists in a circulation of matter (cf. Schmidt 1971: 86–7). The German philosopher Schelling also used this notion to develop parts of his natural philosophy. Indeed, the title of one of his writings is 'Von der Weltseele, eine Hypothese der höheren Physik zur Erklärung des allgemeinen Organismus' (Schelling 1927).²⁰ The curious thing with Moleschott and Liebig is that they coin the term *Stoffwechsel* with analogy to social concepts: Moleschott makes reference to commerce, Liebig to politics. We have thus to take into account that at least some categories in the natural sciences were coined by explicit or implicit reference to social phenomena. This reciprocal process has also been noted by Schmidt:

Since classical times, and right up to Machiavelli and even Pareto, alterations in the configuration of society have been understood as part of a cyclical movement proceeding according to natural laws. We find, just as early, attempts to interpret the changes and mutual interactions of natural objects by means of social categories. (Schmidt 1971: 92)

As we just have seen, Darwin can also be added to this list; he also tried to make plausible the use of a concept (differentiation)

²⁰ It is worth noting that Schelling's philosophy has also been interpreted as a forerunner of the new paradigms of self-organization, self-reproduction, and autopoiesis—see Heuser-Kessler 1986: 52.

by means of an analogy, in this case to the technical world (see his knife example). Furthermore, Darwin also transposed a mechanism from the social world to the natural world, namely Malthus's 'struggle for existence' (see Rottleuthner 1988: 109)—a procedure which amused Marx.²¹ Wolf Lepenies has shown that the concept of division of labour went back and forth between sociology and biology: 'Spencer spoke of reciprocity (*Wechselwirkung*) as he showed that biology borrowed the concept of division of labour from sociology in order to return it in an enriched form. Reciprocity signifies the transfer of a concept from one scientific discipline to another and then back into the original discipline' (Lepenies 1976: 172, cited in Rottleuthner 1988: 101).

To come to my own use of such analogies: as will become clear in the following discussion, evolutionary concepts in social theory indeed borrow much from biology (see Weick 1979). There are several authors who believe that central notions of evolutionary theory can be put to use in the explanation of social phenomena and social change. In Chapter 4, I shall test the potential of such an approach in comparison to the standard Marxist approach (as expressed in the 1859 *Preface*).

3.1.3. Marx's machine definition

Now look at Marx's definition of what a machine is. He rejects several definitions, among them the following:

The explanation that a machine is a complicated tool and a tool a simple machine explains nothing. The explanation that we have a machine where the tool is not moved by human power and that we have a tool where the human being is the prime mover . . . mistakes a dog's cart . . . for a machine and the mechanical spinning wheel . . . for a tool. *It contains nothing which could explain historical change.* (MEGA II. iii. 6. 1951, my emphasis)

²¹ See the letter to Engels of 18 June 1862: 'It is remarkable how Darwin recognises among beasts and plants his English society with its division of labour, competition, opening up of new markets, inventions and the Malthusian "struggle for existence". His [nature] is Hobbes' *bellum omnium contra omnes* and one is reminded of Hegel's *Phenomenology*, where civil society is described as a "spiritual animal kingdom", while in Darwin the animal kingdom figures as civil society.'

In a letter to Engels he explains several attempts to define a machine:

You may or you may not know, for of itself the thing's quite immaterial, that there is considerable controversy as to what distinguishes a machine from a tool . . . if we take a look at the machine in its elementary form, there can be no doubt that the industrial revolution originates, not from motive power, but from that part of machinery called the *WORKING MACHINE* by the English, i.e. not from, say, the use of water or steam in the place of the foot to move the spinning wheel, but from the transformation of the actual spinning process itself, and the elimination of that part of human labour that was not mere *EXERTION OF POWER* (as in treading a wheel), but was concerned with processing, working directly on the material to be processed. (Letter to Engels, 28 Jan. 1863)

Marx aims to identify a technological element which is able to produce social change. The point for Marx is not to have a good definition for its own sake but to have a definition which is able to capture the advent of the industrial revolution. It is precisely here that the definitions of the Englishmen and the Germans fail. Marx emphasizes his special interest when he admits that '[t]o those who are merely mathematicians, these questions are of no great moment, but *they assume great importance when it comes to establishing a connection between human social relations and the development of these material modes of production*' (letter to Engels of 28 Jan. 1863, my emphasis). According to Marx, then, the important difference is the existence of a mechanism, which can be found in the models of the clock and the mill. According to him, '[t]he clock was the first automatic device to be used for practical purposes, and from it the whole theory of the production of regular motion evolved' (ibid.). Marx is aware that machines (which conform to this definition) have been employed for a long time. But with their use on a broader level a specific dynamics occurs which leads to the industrial revolution: 'The industrial revolution began as soon as mechanical means were employed in fields where, from time immemorial, the final result had called for human labour and not therefore—as in the case of the above-mentioned tools—where the actual material to be processed had never, within living memory, been directly connected with the human hand; where, by the nature of things and from the outset, man has not

functioned purely as POWER' (letter to Engels of 28 Jan. 1863). He thus rejects both the definition of the English technologists who 'call a tool a simple machine and a machine a complicated tool' and the definition of the 'German jackasses, who are great on little matters like this' and call a plough a machine because it is not moved by human power.²² Instead, he agrees with Babbage who defines the machine in the following way:

When each process has been reduced to the use of some simple tool, the union of all these tools, actuated by one moving power, constitutes a machine. In contriving tools and simplifying processes, the operative workmen are, perhaps, most successful; but it requires for other habits to combine into one machine these scattered arts. (Babbage 1971: 174)²³

Marx comments: 'What we stress here is not only the reduction "de chaque opération particulière à l'emploi d'un instrument simple" [of each process to the use of some simple tool], but what is involved in it, i.e. creation of these "instruments simples" on the basis of the division of labour' (MEGA II. iii. 6. 1914). It is not important what the motor is. It may be the human hand and foot, animal powers, elementary powers, or an automaton (mechanical powers) (cf. MEGA II. iii. 6. 1914). The only important thing is that virtuosity and skill get transposed from the worker to the mechanism: 'However, those operations which formerly needed the virtuoso who played on the instrument are now produced by the transformation of the most simple movements (caused by human beings, like turning a handle, treading a wheel) into the refined movements of the machine' (MEGA II. iii. 6. 1917).²⁴

²² In a letter to Engels he admits to being 'in considerable doubt about the section in my book that deals with machinery. I have never been quite able to see in what way SELF-ACTORS changed spinning, or rather, since steam power was already in use before then, how it was that the spinner, despite steam power, had to intervene with his motive power' (letter of 24 Jan. 1863). And, in the letter of 28 Jan. of the same year: 'For me, mechanics presents much the same problem as language. I understand the mathematical laws, but the simplest technical reality that calls for ocular knowledge is more difficult for me than most complicated combinations.' For this reason, Marx was attending a practical course for working men in the Institute of Geology (cf. CW xli. 446, 449).

²³ Cf. also *The Poverty of Philosophy*, CW vi. 186, as cited above.

²⁴ See also the following passage from the *Grundrisse*: '[I]t is the machinery which possesses skill and strength, is itself the virtuoso, with a soul of its own in the mechanical laws acting through it . . . The workers' activity, reduced to a mere abstraction of activity, is determined and regulated on all sides by the movement of machinery and not the opposite' (*Grundrisse* 693).

Machinery rests upon simple co-operation and division of labour, but changes them at the same time.²⁵

As soon as machinery is employed in a capitalist way . . . it presupposes simple co-operation. This appears in this context . . . as a much more important moment than it was when manufacture rested on the division of labour . . . which repeats itself inside the mechanical atelier, albeit on a lower scale; and, as we shall see later, the mechanical atelier overthrows the main principles of manufacture, based on the division of labour. Finally, the use of machinery increases the division of labour within society, the multiplication of special trades and autonomous branches. *Their basic principle is to be found in the replacement of skilled labour by simple labour.* (MEGA II. iii. 1. 294, my emphasis)

Marx distinguishes historically two stages of transition to machine work. The first is the development of machines which have their origin in primitive tools and which eventually led to the production of machines by means of machines.

There are two classical examples of machinery which emerge in this way: on the one hand spinning and weaving machines which develop out of the oldest tools . . . On the other hand construction of machinery by means of machinery . . . Historically, the revolution in industry starts with the first. It is in the very nature of things that only after the production of commodities by machinery has reached a certain size does the need become felt to produce machinery by machinery. (MEGA II. iii. 6. 1915)

In the case of the spinning machine, the worker was reduced to merely driving the wheel. The mass of the product was no longer in direct proportion to the physical expense of power. The decisive feature of machinery is that a mechanism performs operations which earlier were performed by a virtuoso who played an instrument:

From the moment that direct human participation in production consisted only in supplying simple power, the principle of work done by machinery was given. The mechanism had become available whereby the human factor could be replaced later by water, steam, etc. (MEGA II. iii. 6. 1917)

The second stage is characterized by the employment of the steam engine: 'After this first big industrial revolution, the use of the

²⁵ See s. 3.6 for a discussion of his concept of 'division of labour'.

steam engine as providing the motive power was the second' (MEGA II. iii. 6. 1917). The historical turning-point, however, is expressed in the first stage (transfer of skill), for the simple reason that mankind always had living automata (=animals) which served as a power source. The important difference has to be seen in the instrument. The plough contained no element which could lead to the industrial revolution: all movements of men and animals were essentially those of free will, the movement was irregular, man had to direct the animals. The mechanical act was hidden behind the movement of man and animal: they themselves were not forced into a strict geometry. The mill, however, can be regarded as the forerunner of machinery; it is the first 'Arbeitswerkzeug' (see MEGA II. iii. 6. 1919). 'This aspect of machinery has also been developed from the mill, i.e. that work which was previously separated from grinding in the strict sense is now done by the same motive power and therefore is mechanically combined with the work of grinding' (MEGA II. iii. 6. 1920–1). It is most important to keep in mind the *differentia specifica* of the machine as defined by Marx. It is the transfer of technical skill from the worker to the instrument. Recall, also, Marx's definition from the *Grundrisse* where he said that the machine is the virtuoso which possesses a soul of its own (see *Grundrisse* 529, 693). In *Capital*, Marx shifts the attention from the technological to the social level (see s. 3.5.).

But let us return to the consequences of Marx's machine definition. The effects on the character of the labour performed under these conditions are summarized as follows:

On the one hand, we have the changed form of labour, its apparent ease which transfers all muscular effort to machinery—but also all virtuosity. The lengthening of the working day therefore does not immediately reach physical limits. On the other hand, the opposition of the worker breaks down since his virtuosity . . . is broken. This impedes the ability of the worker to resist and it allows capital to replace skilled workers with unskilled workers who more readily submit to control. (MEGA II. iii. I. 303)

This new reality, which is in the first instance a technological one, has tremendous social consequences, and negative ones for the workers. Marx says that a new class of workers, i.e. women and children, is entering the production process, a class which is

completely obedient to the despotism of capital. Furthermore, capitalist use of machinery lengthens the working day instead of shortening it: 'Once the working day has been forcibly prolonged, it takes ages (as in England) for the workers to reduce it back to its previous level' (MEGA II. iii. 1. 303).

3.1.4. *The machinery question*

The machinery question in early nineteenth-century Britain was the question of the sources of technical progress and the impact of the introduction of the new technology of the period on the total economy and society. The question was central to everyday relations between master and workman but it was also of major theoretical and ideological interest. The very technology at the basis of economy and society was a platform of challenge and struggle. (Berg 1982: 9).

Basically, there were two attitudes towards machinery: one which welcomed it and saw it as an instance of progress; another which condemned it, stressing its dehumanizing effects. The following quote from John Stuart Mill may serve as an example of the first attitude: 'The more visible fruits of scientific progress . . . the mechanical improvements, the steam engine, the railroads, carry the feeling of admiration for the modern, and disrespect for ancient times, even down to the wholly uneducated classes' (Mill 1865: 148; see also Marx 1964: ch. 4). The counter-position was expressed by writers like Thomas Carlyle or Charles Dickens. Carlyle's cultural critique comes out clearly when he compares 'the living artisan' with the inanimate one: 'The huge demon of Mechanism smokes and thunders, panting at his great task, in all sections of English land; changing his shape like a very Proteus; and, infallibly, at every change of shape, *oversetting* whole multitudes of workmen, as if with the waving of his shadow from afar, hurling them asunder, this way and that, in their crowded march and curse of work or traffic' (Carlyle 1980: xxiii. 24).

Marx was caught between these attitudes. He saw both the progressive character of machinery and also its debasing effects.²⁶ He tried to combine both positions, pointing to a higher form of

²⁶ The latter are sharply expressed in the early *Paris Manuscripts*, but also in *Capital*. The difference is that *Capital* conceives the debasing effects as due only to the capitalist use of machinery.

industrial society where the negative features would have vanished. Carlyle depicted machinery as a 'huge, dead, immeasurable steam engine, rolling on, in its dead indifference' (Carlyle 1885–8, cited in Berg 1982: 12). Marx, in *Capital*, describes a 'mechanical monster whose body fills whole factories, and whose demon power, at first veiled under the slow and measured motions of his giant limbs, at length breaks out into the fast and furious whirl of his countless working organs' (*Capital* i. 381–2).

This expresses an anxiety felt by many contemporaries of Marx and still felt by many people today.²⁷ When Dickens complained that in modern society everything was quantified, mechanized, calculated as 'so many hundred hands in this mill; so many hundreds horse steampower',²⁸ Marx would stress the potential for liberating mankind *on the basis of this scientific method*. In *Capital* he praises modern industry in the following way:

Modern Industry rent the veil that concealed from men their own social process of production and that turned the various, spontaneously divided branches of production into so many riddles, not only to outsiders, but even to the initiated. The principle which is pursued, of resolving each process into its constituent movements, without any regard to their possible execution by the hand of man, created the new modern science of technology. The varied, apparently unconnected, and petrified forms of the industrial process now resolved themselves into so many conscious and systematic applications of natural science to the attainment of given useful effects. (*Capital* i. 456–7)

From this quote at least we may conjecture that Marx ultimately gave more emphasis to the progressive aspect of machinery than to the 'spiritual' consequences.²⁹ This has to do with the emancipatory role he attributed to science, as we shall now see.

3.1.5. Science and technology

It is a commonplace that the main facet of modern technology is the growing influence of science. Little agreement exists on whether science or technology has a *prius* over the other, or,

²⁷ Charles Babbage also expressed such an anxiety—see Berg 1982: 11–12.

²⁸ Dickens 1969, as cited in Berg 1982: 13.

²⁹ To be sure, this is also the way in which mainstream Marxism presented its answer to the question of 'technical progress'.

more generally, how the relation between the two has to be conceptualized. In a recent debate, Fores denied the scientific character of technology (modern or otherwise). He maintains that there is nothing identifiable which could be called technology; it is only *Technik* which is worth talking about. According to him, 'it makes no more sense to ask an engineer to be "scientific" than to ask a lawyer to "be seamanly" or a sailor to "act like good cook"' (Fores 1988: 71). In his view, engineering science is a 'myth'. However, this view is contrary to a long tradition of conceptualizing modern technology which I cannot represent adequately here for reasons of time and space. Suffice it to say that, from Ure, Babbage, and Marx onwards, technology's main characteristic was seen in the growing application of scientific findings. This does not mean that technology has to await some 'ordered' scientific results, or that technology is 'applied science'; rather it means that modern technology as such incorporates skills, knowledge, and experience, and thereby some—at least minimal—scientific knowledge.³⁰ However, Fores is right to insist on the distinction between science and technology. In order to pursue this issue further, I now explore Marx's thought on this matter, confronting it with some contemporary analyses.

Marx conceives the relationship between science and technology under capitalism in the following way:

In machinery, the appropriation of living labour by capital achieves a direct reality in this respect as well: it is, firstly, the analysis and application of mechanical and chemical laws, arising directly out of science, which enables the machine to perform the same labour as that previously performed by the worker. (*Grundrisse* 703–4)

In the following statement in the *Manuscripts 1861–3* he exaggerates the influence of science upon technology to some extent

³⁰ Scheler (1980), in an illuminating study, has claimed that it is logic, mathematics, and the practice of observing and measuring that form the driving force for technical development (basic to both science and technology is the *Machtgedanke*, the will to power). Scheler thinks that *Technik* does not in the first place consist in constructing 'economically efficient' machines, but, following its own logic, 'The basic value which guides the new technologies aims at constructing . . . all possible machines. First, this is carried out in thought and as a plan' (Scheler 1980: 125, my trans.). Only after that are two further selections made: one by the engineer, the other by the entrepreneur (cf. *ibid.* 127); see also Rapp 1978: 70. I come back to Scheler in s. 3.3.

when he says that every scientific discovery serves as a base for a new technological invention:

Every discovery becomes a basis for further invention or for new and better methods of production. Only the capitalist mode of production puts science at the service of the immediate process of production, while, on the other hand, the development of production provides the means for the theoretical subjugation of nature . . . Capital does not create science but exploits it, adapts it to the production process. Hand in hand with this goes the separation of science (science applied to production) from immediate labour. (*MEGA* II. iii. 6. 2060)

Marx's very concept of the machine would not work without the role of science. As he propounded at length in *Capital*, it was only with the emergence of machinery that science could be applied to the production process in an unprecedented way. Rosenberg observed: 'By breaking down the productive process into objectively identifiable component parts, it creates a structure of activities which is really amenable for rigorous analysis' (Rosenberg 1976b: 133). Marx himself put it this way:

The principle, carried out in the factory system, of analysing the process of production into its constituent parts, and of solving the problems thus proposed by the application of mechanics, of chemistry, and of the whole range of the natural sciences, becomes the determining principle everywhere. (*Capital* I. 434)

This is a quite recent phenomenon. To be sure, science and capital have existed for centuries without giving rise to the above-described process of analysing the production process and applying scientific knowledge to it. 'It is only at a very recent point in history, Marx argues, that the marriage of science and industry occurs. Moreover, this marriage does not coincide with the historical emergence of capitalism' (Rosenberg 1976a: 130). In modern industry, technology is for the first time not designed in accordance with the physical endowments of the workers 'but in accordance with a completely different logic, a logic which explicitly incorporates principles of science and engineering' (ibid. 132).

But the mere growth of science is not a sufficient condition for the growth of productivity. Neither is it justified to think of technology as *application* of scientific knowledge. As Rosenberg put it, 'this perspective obscures a very elemental point: techno-

logy is itself a body of knowledge about certain classes of events and activities. It is not merely the application of knowledge brought from another sphere . . . It is . . . not a fundamental kind of knowledge, but rather a form of knowledge that has generated a certain rate of economic progress for thousands of years' (Rosenberg 1982b: 143).

Thus technology may develop on its own, without the guiding function of science. Marx was also aware of this when stressing the 'eigendynamics' of technology:

Invention then becomes a business, and the application of science to direct production itself becomes a prospect which determines and solicits it. But this is not the road along which machinery, by and large, *arose*, and even less the road on which it progresses in detail. The road is rather dissection [*Analyse*]³¹—through the division of labour, which gradually transforms the workers' operations into more and more mechanical ones, so that at a certain point a mechanism can step into their places. (*Grundrisse* 704, my emphasis)³¹

It is doubtful if Marx would have agreed with attributing the following characteristics to a communist society:

[T]he normal situation in the past and to a considerable degree also in the present, is that technological knowledge has preceded scientific knowledge . . . Thus, it is to be expected that feasible technological knowledge is likely to be attained before the deeper level of scientific understanding. At least this is so if sufficiently powerful economic incentives are at work. (Rosenberg 1982b: 144)

Perrow, analysing high-risk systems, points out that poorly designed or poorly understood technological systems are likely to lead to accidents:

Transformation processes exist in recombinant DNA technology, chemical plants, nuclear power production, nuclear weapons, and some aspects of space missions. Most of these are quite new, but it is

³¹ See Hegel: 'In a case where factory work has been made so perfect and simple, a machine can work instead of a human being and this is the normal transition which now takes place inside the factories' (Hegel 1983b: 127, my trans.). Avineri comments: 'We thus have here, in one of the most speculative documents of German idealist philosophy, one of the most acute insights into the working of modern, industrial society: from *a priori* philosophical anthropology, Hegel moves on to incorporate the results of political economy into a philosophical system—an attempt almost identical in its systematic structure with Marx's program forty years later' (Avineri 1972: 94).

significant that chemical processing is not. While experience has helped reduce accidents, accidents continue to plague transformation processes that are fifty years old. These are processes that can be described but not really understood. They were often discovered through trial and error, and what passes for understanding is really only a description of something that works. (Perrow 1984: 85)

Marx, on the other hand, doubtless assumed an ever more explanatory and projective force of science when he wrote:

But to the degree that large industry develops, the creation of real wealth comes to depend less on labour time and on the amount of labour employed than on the power of the agencies set in motion during labour time, whose 'powerful effectiveness' . . . depends rather on the general state of science and on the progress of technology, or the application of this science to production . . . Agriculture, e.g., becomes merely the application of the science of material metabolism, its regulation for the greatest advantage of the entire body of society. (*Grundrisse* 704–5)

Equally optimistic was his trust in technological possibilities: 'Mirabeau's "Impossible! Ne me dites jamais ce bête de mot!" is particularly applicable to modern technology' (*Capital* i. 448). He speaks of an ever-increasing productivity of labour together 'with the uninterrupted advance of science and technology' (*Capital* i. 567). At this point in his theory, Marx seems to enlarge his theoretical scheme according to which man transforms nature with the help of technology. Now the role of science becomes crucial.

Here an intriguing question arises: how can we reconcile Marx's statement that technology develops relatively autonomously, i.e. independently of science, on the one hand, with his statement, on the other hand, that science will to an ever greater extent determine the course of technology?

Marx's theory offers two possibilities for such a synthesis. First, we can again apply the distinction between a historical and a critical approach, which in Marx's case is represented in the difference between an analysis which is 'backward-looking' and one which is 'forward-looking'. The second possibility is contained in his claim that human labour will be able to reappropriate all sorts of objectifications, including modern technology. It is true that a rural idyll is the reference point in the famous

passage from the *German Ideology* (fishing and hunting); but in the same text, Marx also says that the highly developed productive forces of capitalism will be appropriated by the producers, which is the very precondition for the full development of the individuals (cf. *CW* v. 86–7 as cited in s. 3.1.1). It is important to note that Marx's basic idea remains the same in this respect, what varies is only the stress he gives to different factors. For example, in the 'Speech at the Anniversary of the *People's Paper*' (1856), he invokes new-fangled men who would master the new-fangled machinery; in the *Grundrisse* he envisages a fully automated production process with man as mere guardian (see the passage cited below); in *Capital* he stresses that there will be varied work also under communism, which makes necessary an all-round development of individuals. But the basic idea of the rural model reappears: it is the explicit claim that any fixation of persons to one exclusive task has to be avoided; the all-round development of human capacities and needs is Marx's goal. Regarding the possibilities for the realization of that goal, Marx's argument is quite optimistic; according to him, it is based on real relations which exist in modern industry. Therefore, fully developed individuality is both the aim of communism and necessitated by capitalist technology. The rural idyll is replaced by a model where individuals, as it were, switch from one activity to another, but they do this on the basis of a scientific and artistic education (which will also generate new needs in them). This model is no Utopia but, according to Marx, inevitable, since modern technology requires it. A functional requirement of modern societies, therefore, leads to the birth of communist man, which is quite an extraordinary claim.

To turn to the scientific dimension, it should be said that Marx analyses technology mainly in its historical development, including its rapid growth under capitalism. He describes this process as an *evolutionary* process. But it is one thing to state with hindsight a blind evolutionary process, another to state it for the future. And here, I suppose, not only could Marx not allow for such a possibility, no humanist position could. This is why Marx distinguished sharply between pre-history and history proper (cf. 1859 *Preface*): the first is governed by blind evolution whereas the second is controlled and planned by human purposes. And this is the place where science becomes most important for

Marx. Science provides the means for a planned technology, for a planned *Stoffwechsel* between man and nature; and, what is more, science for Marx was not only a desideratum, but a real, unfolding ('before our eyes') force. Under the regime of science, the gap between explanation and evaluation, between blind evolution and conscious human control, between pre-history and history could be bridged.³² For Marx it is an empirical fact that modern industry (capitalism) already leads mankind to the threshold of history proper. Look at his bold outline in the *Grundrisse* where he sketches some breathtaking scenarios for a technologically advanced, communist society:

Labour no longer appears so much to be included within the production process; rather the human being comes to relate more as watchman and regulator to the production process itself . . . No longer does the worker insert a modified natural thing [*Naturgegenstand*] as middle link between the object and himself; rather he inserts the process of nature, transformed into an industrial process, as a means between himself and inorganic nature, mastering it. He steps to the side of the production process instead of being its chief actor. In this transformation, it is neither the direct human labour he himself performs, nor the time during which he works, but rather the appropriation of his own general productive power, his understanding of nature, and his mastery over it by virtue of his presence as a social body—it is, in a word, the development of the social individual which appears as the great foundation-stone of production and of wealth. (*Grundrisse* 705)

Marx's optimism with regard to the transparency of technological processes must be subjected to critical examination. It seems that it does not concord with the reality of modern technology. Perrow emphasized four dimensions of technological systems: linear/complex and loose/tight coupled. The point is that Marx excludes the complex dimension from his analysis when stressing that the production process gets 'dissected' into its component parts. This suggests that every instrument in the production process serves only one purpose: the production process takes place step by step. However, examples from the chemical and

³² This general outline seems still to apply to present-day problems of industrial accidents. As Perrow has pointed out, it is due to the poor scientific understanding of existing technological systems that their working is sometimes dangerous. This view can be contrasted with the standard explanation which assumes perfect functioning of technology and simply blames the operators in case of an accident.

electrical industries indicate that there is also a reverse tendency to observe: parts or components of technical systems are designed so as to fulfil more than one function (cf. Perrow 1984).

To return to the problem of science and technology in Marx. Above, I suggested that we can reconcile the autonomous development of technology and the increasing influence of science in Marx's model with the distinction between historical and critical analysis. But apart from the exegetical task, we are still left with the crucial question: how do we distinguish science from technology and what does their relation look like?

Rosenberg holds that science and technology are essentially two different things which have things in common, but are, in the first place, distinct from each other. The difference lies in the specific character of knowledge which is employed. In the case of science we have rules, laws, and procedures which can be written down and discussed by the academic profession. In the case of technology, the knowledge which is sometimes employed cannot be explained; technical solutions are found which demand scientific explanation. From this it follows that technology cannot simply be conceived as *applied science*. According to Rosenberg, the main bulk of inventions and technical-practical solutions were found long before a scientific explanation could account for them. 'It is still far from unusual for engineers in many industries to develop a successful solution to a problem for which there is no scientific explanation and for the engineering solution to generate the subsequent scientific research that eventually provides the explanation' (Rosenberg 1982b: 144; see also Marx: science depends on the development of trade and industry, cf. *CW* v. 40).³³

Price, in a similar vein, says that 'the naive picture of technology as applied science simply will not fit all the facts. Inventions do not hang like fruits on a scientific tree' (Price 1982: 169).

³³ Heidegger made the same point when he wrote: 'It is said that modern technology is something incomparably different from all earlier technologies because it is based on modern physics as an exact science. Meanwhile we have come to understand more clearly that the reverse holds true as well: modern physics, as experimental, is dependent upon technical apparatus and upon progress in the building of apparatus' (Heidegger 1978: 295–6). One strand in the sociology of science takes up exactly this point in stressing the hermeneutic character of the natural sciences, see Bloor 1976; Barnes 1977; Mulkay 1979; Knorr-Cetina 1985. For a criticism, see Archer 1987.

Instead, so he argues, 'most technological advances derive immediately from those that precede them . . . old technology breeds new in just the same way as the scientific process' (Price 1982: 170). Such a characterization would presuppose that technology, like science, could be conceived as a social system (for further discussion see s. 3.3). Price bypasses this difficulty in assuming that old technology breeds new, just as old knowledge breeds new,³⁴ and in endorsing an actor model in explaining the transfer of knowledge from science to technology. He sees the relationship between the two as an 'interaction' (which takes place between persons) since we know of many cases in which science has passed into technology and technology has made possible new science (cf. *ibid.* 171). But the *prius* is science since he notes a time-lag between scientific and technological advance. Price takes an image from Toynbee in order to illustrate the relation between the two. The image is of two dancers, dancing to the same music: it is 'impossible to tell who is leading, and who following' (*ibid.* 170).

But, '[r]ather than supposing that an outside force affects both dancers, it seems more reasonable to think that their action upon each other keeps them in step' (*ibid.* 171). Since the influence is reciprocal, we must assume a complete interaction (*ibid.*). However, there is a time-lag between scientific and technological advance which 'would seem to indicate that the dancers hold each other at arm's length instead of dancing cheek to cheek. To use the more precise language of the physicist, the relation between science and technology seems to be a weak rather than a strong interaction' (*ibid.*).

To explain the interaction, Price employs an actor model and stresses the important role of socialization of the respective actors (i.e. scientists and engineers): '[T]he medium of transmission is the person and the method is the fact of the formal or informal education' (*ibid.*). By this mechanism, Price explains the time-lag between the two disciplines: it is simply that both scientists and technologists, during their education, are subjected to some training in the ambient state of the respective other discipline. 'It follows then that men on the research fronts of

³⁴ Cf. also: 'One can, I suppose, create technology to order, just by wishing it. But ordinarily one is severely constrained by the old technology's having or not having the capacity to breed a particular desired thing' (Price 1982: 170).

science and technology will be able to use each other's ambient knowledge. It seems too that this will generally be the ambient knowledge that is on the average about one generation of students old—perhaps ten years' (*ibid.*).³⁵

How hard it is for science and technology to communicate has been convincingly stated by Price in the following way:

In any case, what communication difficulty there is seems due to the fact that though the scientists want to write and the technologists want to read, the scientists are writing for their colleagues in science, or sometimes for their imaginary archive; they are simply not writing the sort of material that the technologists want to read. This frustrates the technologists and makes them believe that somewhere in this pile of material, if only they could find it, there is the very valuable material they are looking for to make new products. (*ibid.* 173)³⁶

In summary, then, there seem to exist few if any channels of communication between science and technology.³⁷ Rosenberg is aware of this, stressing the distinct character and development of the two. To stick to the picture, the dancers are still dancing together, but to different kinds of music. He emphasizes the central role which technology has always played in the history of mankind, thus clearly referring to Marx's concept of *Stoffwechsel* (cf. Rosenberg 1982a: 41). He concludes that technology as such can proceed without the guidance or assistance of science. 'Indeed, if the human race had been confined to technologies that were understood in a scientific sense, it would have passed from the scene long ago' (Rosenberg 1982b: 143).³⁸

Technology sets the agenda for scientific research, provides the empirical data without which the latter cannot start. Rosenberg straightforwardly reverses the common view that science is prior to technology: it is technology which 'influences scientific

³⁵ Note that this explanation does not depend on an actor model; the same could be said for a systems approach: each system uses information from its environment, i.e. from other systems too.

³⁶ Marx provides an example from hydraulics in the 18th century: 'Hydraulics and hydrotechnology have been enriched by the many discoveries of the 18th century with beneficial consequences for the miller's art which, however, followed theoretical progress only slowly (especially in Germany) . . . The theory of water wheels was difficult, therefore it was denigrated as an empty theory, the builders of the mills hardly considered it' (MEGA II. iii. 6. 1924).

³⁷ See Stichweh 1987: 473, for another example.

³⁸ Cf. also his statement that science and technology represent two different forms of knowledge. See Rosenberg 1982a: 143, as cited above.

activity in numerous and pervasive ways' (Rosenberg 1982b: 142). In this conception, technology provides empirical data for science just as nature does. To be sure, both science and technology have to do with man's *Stoffwechsel* with nature; whereas technology is practical-empirical transformation of physical objects, I shall define science as one form of social communication about this process.³⁹ Science uses the empirical data provided by nature and technology as information on which it builds its own system (see s. 3.3. for further elaboration).

How can we relate Marx's findings about modern industry to this distinction? Marx emphasizes the important role of science in the modern capitalist production process. Machinery is for him the bodily expression of the abstract principles of science. This is not to say, however, that machinery is the mere application of scientific knowledge nor to say that science comes before technology. What Marx stresses is the fact that in modern industry scientific knowledge could be applied for the first time in a systematic way and on a large level, and that modern industry gave rise to the expansion and importance of scientific research. Yet, what is more, Marx's stress on the important role played by science is crucial for his communist perspective. Recall the distinction of nature₁ and nature₂ from Chapter 2. It is only under the condition of transforming nature₁ into nature₂ and understanding this transformation that mankind liberates itself from alien powers. We must thus regard Marx's position as a position which privileges the scientific over the technological dimension, for only a second nature which is understood provides the basis for communist society. It is quite obvious that technologies which are just technical installations and happen to work cannot provide the technological basis for communist society. They cannot provide this basis, especially under modern conditions where technologies may affect large parts of the globe and its populations in a detrimental way over a long period of time.

In summary, then, we might say that science and technology are different fields of human activity which are quite distinct as regards their basic characteristics. But they also influence each other, constituting a relationship which is vital for modern

³⁹ Also Marx in the *Grundrisse* distinguishes a material and a mental dimension of the *Stoffwechsel*, see *Grundrisse* 161.

industry (see s.3.3 for other interrelations). To be sure, technology is not 'applied science', but it is true that some scientific findings get embodied in technical apparatus.

3.1.6. What is wrong with machinery?

Machinery represents a form of constant capital and therefore a social relation but it also represents an embodiment of human control over nature, that is, it is also a material means to provide society with the possibility of transforming nature. The well-known part of Marx's theory, and the one which became historically relevant, has it that technology as such is a neutral means by the help of which mankind progresses towards communism. The specific social form of technology in capitalism (i.e. as fixed capital) is the barrier to a full liberation of technology's potential. It is the peel which has to be stripped off by proletarian revolution. This model is defective for all the reasons we know today and Marx would no longer deserve any attention if he had no more to offer. In effect, he has more to offer, and this leads us to some very interesting ambiguities in his theoretical framework.

In this section I briefly point out that the distinction between technology as social form and technology as material artefact was known by Marx and that he, in the years when he was preparing *Das Kapital* for publication, was not clear how to treat it. In the writings from these years we witness how he analyses machine technology not only in terms of social form but also in terms of material artefact. He discovers that:

1. machinery not only dispossesses the worker of the surplus-value produced by him but also deprives him of his skill and virtuosity.

This is a worrying discovery for an author who also holds the following two important views:

2. an ideal of human self-realization which calls for the full development of man's species powers; and
3. an evolutionary view of historical and technological development, with the important claim that every existing form emerges out of a pre-existing form by way of differentiation.

If we take these two views together with the discovery that machine technology is deskilling and dehumanizing, Marx is

left with the uncomfortable result that machinery as such is alienating. The project of communism must then rely upon the contingent occurrence of a new, liberating technology. Since this standpoint was clearly unacceptable to Marx, he took another way out of the dilemma. He put all guilt on the capitalist social form and not on the material substratum of machinery. Therefore,

- 1(a) only capitalist machinery is alienating and depriving workers.

This solution does not come as a surprise from an author who, writing in the nineteenth century, saw all evils of society rooted in capitalism. The political aim was the overthrow of the bourgeoisie, an event which should pave the way to a society without domination, exploitation, and alienation. Experience of both 'real socialism' and *global* ecological problems tells us that Marx's solution to the dilemma is defective. The re-evaluation of this question can lead to quite dramatic consequences, not only for true Marxist believers but also for anyone whose interest is linked to human emancipation. Roughly speaking, the consequences would amount to the following:

4. Given that technology has the traits described by Marx, alienation has to be considered part of the modern human condition. Emancipation depends on the incidental emergence of new, liberating technologies;
5. Given that technology not only cripples and deprives the workers but also degrades the natural environment, ecological problems do not follow from the capitalist use but from the inner logic of technology as such.

Contemporary theorists either drop premiss (2) and claim that mankind has to survive and forget about Enlightenment ideals, or they proclaim (5) and conclude that industrial production has to be abolished where possible. However, these solutions have as little foundation as Marx's own. Therefore, let us explore the possibility of consistently holding together views (1), (2), (3), avoiding conclusions (1a), (4), and (5). This solution would be easy if one could point to real existing technologies which promote human self-realization and do not disrupt the environment. Since this is hardly the usual case, in general the solution depends upon the possibility that modern complex

societies can direct technological development. If they could do so, they would come closer to the ideal of communist society, namely being able to control their fate consciously. The political focus thus switches from the objective of proletarian revolution to the problems of 'intersystemic planning' (see s.4.2 for further development and literature).

3.1.7. Progress?

One could distinguish several criteria for measuring progress. There are economic criteria, regarding productivity or per capita income. Productivity is usually defined as the relation between costs and benefits, between investments and pay-offs. Higher productivity thus means to achieve the same output with less investment, or, which is the same, to achieve more output with the same amount of investment.⁴⁰ Another criterion would be one which is purely immanent to technology and which judges technological features like reliability, speed, longevity, energy input, etc. Still another criterion would be spiritual in that it asks if people are freer or happier in comparison to former states in history.

The latter two criteria seem to cause difficulties. For how can we distinguish different levels or stages of evolution in the technological or ethical realm? And, more penetratingly, is progress involved in this development? With Weick we could say again: all depends on which criteria we want to use. There are no absolute standards regarding technical criteria: they are all dependent on a social-cultural-economic context. A technology which comes later in time need not be 'superior' to a previous technology (see Rammert 1988).

Let us, therefore, look for a moment at spiritual criteria in judging progress. In a very stimulating book on Goethe's *Faust*, Binswanger (1985) pointed out that along with modern economic growth, mankind witnessed two major losses: beauty and (technical and economic) security.⁴¹ If we now contrast the purely

⁴⁰ Marx is not precise when he writes that 'the growth of the productive forces of labour means merely that less direct labour is required in order to make a larger product' (*Grundrisse* 831, see also *MEGA* II. iii. 6. 2144, as cited below), since it is sufficient that the same product is produced with less labour.

⁴¹ Binswanger distinguishes the latter again into 'risk' and 'worry' (*Sorge*), see Binswanger 1985: 65-70.

economic and technical criteria with the spiritual criteria, we can conclude that the overall development need not establish an unequivocal progress. Marx's criteria, in fact, were not only economic and technical, but also spiritual.⁴² For Marx, real wealth is not only, or primarily, expressed in value or material goods, but in total individuals. Neither does Marx neglect the physical aspect of material production. Again, unlike the economists, he does take into account qualitative criteria (as when he praises the ancient world for caring most about the quality of the products), he does stress the need to transform nature with respect to the well-being of individuals. Both points make clear that the charge against standard economics of neglecting the natural environment cannot be made against Marx.

It is common in interpretation to neglect the latter element in Marx. Thus, the following critique by Luhmann is misconceived. He charges Marx (and Durkheim) with employing an 'evolutionist' position, since they used the notion of 'division of labour': 'This theoretical approach [division of labour] makes a conception of historical progress (including Marx and Durkheim) inevitable' (Luhmann 1984b: 320, my translation). Ironically, Luhmann's charge backfires: with the same legitimation we could charge him with being committed to a strong notion of progress because he employs the concepts of 'functional differentiation' and 'increase in complexity'. Similarly, one could charge him with claiming that the more complexity we have in society, the more progress exists. As Luhmann himself says, evolutionary processes are developments which display some succession of order to an observer. This means that it is the observer's criteria of order which are crucial here. The evaluation of this process is equally observer-dependent. If, for example, an observer labels an evolutionary process as 'progress', he has to show the criteria for doing so. Darwinian theory is not usually

⁴² Cohen, for example, stresses only the economic criteria when he writes: 'The United States can produce, much more abundantly per head, everything the medievals could produce, and more besides, with the exception of certain products perhaps wholly beyond its reach, such as, say, stained glass of the kind found on Notre Dame Cathedral . . . The concept of need is not easy to handle, but it would be hard to maintain that the unavailability of just that kind of stained glass generates an overwhelming frustration' (Cohen 1978: 60). But these are issues at stake when we discuss the question of progress—in this case, a loss of beauty.

committed to any notion of progress whereas Marxist social theory definitely is. However, Marx did present his normative assumptions. In the *Manuscripts 1861–3*, Marx takes sides with Ricardo against Sismondi, defending the former's appraisal of 'production for the sake of production':

Ricardo conceives, rightly for his time, of the capitalist mode of production as the most advantageous for the production of wealth. He wants production for the sake of production and this is right. Were one to claim, as sentimental opponents of Ricardo have done, that production as such is not the purpose, one forgets that production for the sake of production means nothing more than development of human productive capacities, i.e. development of the wealth of human nature as an end in itself. (MEGA II. iii. 3. 768)

Marx praises Ricardo's scientific honesty; nevertheless, Marx distinguishes himself also in this respect from Ricardo. Consider the following quote from the same page of the MEGA:

Ricardo's disregard was not only scientifically honest but a scientific imperative for his viewpoint. For this reason he is completely indifferent to the question of whether the development of the productive forces kills landed property or workers. If this progress depreciates capital of the industrial bourgeoisie, he also welcomes it . . . Who cares, says Ricardo: The productivity of human labour has been doubled. (MEGA II. iii. 3. 768)⁴³

But Marx does not say 'who cares?' when workers are crushed in the factories. Rather, his analyses were 'fired by outrage and indignation and the burning desire for a better world' (Lukes 1985: 3). Neither does Marx content himself with an increase in material wealth since this wealth assumes antagonistic forms *vis-à-vis* the producers. Material wealth here leads to a domination of things over persons, since the creation of use-values in capitalism is achieved at the expense of the individuals. Specialization and dehumanization are the main means of achieving it (cf. MEGA II. iii. 6. 2164–5).

⁴³ But cf. Marx's judgement of Malthus on the preceding page, MEGA II. iii. 3. 767.

3.2. Evolutionary approaches to technology in economic theory

A recent strand in economic theory, especially Neo-Schumpeterian economics, conceives technology in an evolutionary way. In the following section, I shall therefore discuss an evolutionary approach to technology and, only after that, several objections to it. The criticisms can be divided into three main strands. The first criticism sees the danger of technological determinism when endorsing an evolutionary approach to technology. The second criticism doubts whether the analogy to Darwinism is legitimate or even feasible. The third criticism doubts whether the distinction between system and environment can be made and asks how the system itself has to be conceptualized. The remainder of this section, and sections 3.3 and 3.4, deal with these problems.

3.2.1. *The behavioural theory of the firm*

Criticizing neo-classical economics, Nelson *et al.* claimed that existing technologies were not chosen because they were indicated by market signals or followed from the rational decision of a firm in order to maximize its profits. On the contrary, so they argued, the technology of a firm is the outcome of a routine; firms do not choose technologies, but *have* them. In their words:

Our principal break with neoclassical tradition lies in our 'behavioral' treatment of the question: why is the firm at any time using the technique it is using? A neoclassical answer would be that the firm has chosen its technique on the basis of profitability calculations comparing the elements of a large choice set (production function). A behavioralist's answer, and the one employed in our model, is of a very different form. The production technique used by a firm at any time is regarded as a complex pattern of routinized behavior, of which the input-output coefficients are a quantifiable aspect. The firm is not seen, at any time, 'choosing' its technique from a large choice set, but rather as 'having' its technique. (Nelson *et al.* 1976: 94)

The point Nelson *et al.* are making here is that they reject the idea that technologies are simply chosen because of their profitability. Rather, firms are developing rules and meta-rules for the

development and selection of technologies. This 'evolutionary' approach to technology has been a very influential one in the recent debate among economists, economic historians, and also among sociologists.

The approach contains, however, several points which proved to be problematic for scholars working on the basis of it. They focused mainly on the question whether technology has 'inner logic' or 'trajectory'. This set of questions is closely related to the methodological question of Darwinian evolutionary theory.

Dosi, building upon the evolutionary approach of Nelson *et al.*, made the explicit analogy to Darwinian theory. Although he does not develop a full analogy to Darwinian theory, we can conclude that Dosi equates specific technologies with 'species', and the environment with economy and society (see Dosi 1984: 20). Now, Dosi holds that the environment does not only select among mutations, but is also selecting the direction of mutations.

[T]he economic and social environment affects technological development in two ways, first selecting the 'direction of mutation' (i.e. selecting the technological paradigm) and then selecting among mutations, in a more Darwinian fashion (i.e. the *ex-post* selection among Schumpeterian trials and errors). (ibid.)

But what exactly does the environment constitute? Dosi stresses three factors: the economy, politics, and institutions. Since there are many possible technologies which could be chosen, it is 'hardly possible to compare and rank them *ex ante*' (ibid. 18). This is witnessed by the 'role often played in the establishment of a particular technological trajectory by public ("political") forces' (ibid.). As examples, Dosi mentions the military and space programmes in the US and the synthetic chemistry in Germany which emerged in the post-Bismarck period out of that country's drive towards self-sufficiency.⁴⁴ 'Bridging institutions' between 'pure' science and applied R & D are also of great importance here. But these three environmental factors do

⁴⁴ Cf. Dosi 1984: 18. Comparing the role of policies with respect to automotive and aircraft technology, another author states: 'In one important respect the development of commercial aircraft and aircraft engines was different from the development of automotive technology. In the case of the automobile the government played no significant role. But government support for the development of military aircraft and aircraft engines generated technology applicable to commercial aircraft' (Klein 1977: 109).

not shape a technological trajectory: technology is still undetermined. As Dosi observes, 'competition does not only occur between the "new" technology and the "old" ones which it tends to substitute, but also among alternative "new" technological approaches' (Dosi 1984: 19). As I shall propose later, the environmental factors economy, politics, and science can be viewed as systems themselves. Technology in this conception is seen as an emergent phenomenon which arises out of the interacting of these three systems. Dosi comes close to a similar statement when he writes that the 'emergence of radically new technological paradigms . . . stems from the complex interplay . . . between advances in science, institutional factors and economic mechanisms' (ibid. 292). These remarks, however, indicate that technology cannot be shown to have a real autonomy, to be a real unity which evolves. Rather, it has to be conceptualized as having an apparent autonomy but essentially dependent on social factors.

Dosi uses not only the analogy to biology in explaining technological trajectories but also an analogy to the philosophy of science, especially to Kuhn's concept of 'paradigms'. This was already hinted at with Nelson *et al.*'s approach when they alluded to Kuhn's *aperçu* 'You can't beat something with nothing', which means that a new scientific paradigm must be able to replace the old one: it is not sufficient to prove the flaws of an established paradigm, if there is no conception which could take its place. Dosi applies this line of thought to technology itself.

In broad analogy with the Kuhnian definition of a 'scientific paradigm', we shall define a 'technological paradigm' as a 'model' and a 'pattern' of solution of *selected* technological problems, based on *selected* principles derived from natural sciences and on *selected* material technologies . . . We will define a *technological trajectory* as the pattern of 'normal' problem-solving activity (i.e. of 'progress') on the grounds of a technological paradigm. (ibid. 14–15)

Dosi offers us a criterion of progress which is immanent to technology itself: problem-solving activities arise within a given technological paradigm and around 'focusing devices'. If they succeed, this could be an instance of 'progress'.⁴⁵ But what if we

⁴⁵ However, the difference between progress and problem-solving activities should be kept in mind. If problem-solving activities succeed, there may be

compare different technological trajectories? In this case, the answer seems not very clear at all; not even evolutionary theory has a ready-made solution to it.⁴⁶ As we shall see, Marx distinguishes in a more general manner between different ('epochal') technologies ('technological trajectories'). According to him, there are three big historical forms: (1) artisan, (2) manufacture, and (3) machines. Each one stands for a specific historical epoch, it is the material base for every social organization (cf. *Capital* i. 352 n.). For Marx, the transition from (1) to (2) and from (2) to (3) was paralleled by an increase in productivity, and, to a certain degree, by 'progress'. His notion of progress, however, is neither purely economic nor purely technological; it also contains an ethical component.⁴⁷

3.3. Technology as a social system?

At this point it may be useful to state again my own position with respect to technology. In my view, technology is a social-material entity which can be conceived in an evolutionary manner. However, it should not be conceptualized as a social system. Consider, first, two important distinctions which we encountered above. One is the distinction between science and technology, the other is the distinction between system and environment. I shall claim that science,⁴⁸ but not technology, can be conceived as a social system. The difference can be described as follows: the first is a homogeneous, well-defined field in which actions or communications are the basic units and in which meaning is transmitted; the second is a

progress in the short run or on the micro-level; from an observer's viewpoint, and/or from the historian's viewpoint, this need not be true. Moreover, it is not said that this 'progress' is a linear, directional process. It could also be a development on a circular, or any other, line. Cf. Rimbaud (1970: 12): 'Science, the new nobility! Progress. The world walks on! Why doesn't it turn around?' (my trans.).

⁴⁶ See again Darwin's refusal to equate evolution with progress, Gould 1973: 36.

⁴⁷ Cf. Marx's judgement of Ricardo, above. See ch. 4 for further discussion.

⁴⁸ And not only science, as we shall see later.

heterogeneous field which has to do primarily with the physical reordering of the world⁴⁹

Renate Mayntz emphasized the difference between social systems and socio-technical systems. According to her, technological systems cannot be analysed as functional subsystems of society because the components of technological systems are not (only) social.⁵⁰ Instead, goes her claim, in analysing *socio-technical systems*, one should leave the ground of the theory of social differentiation and conceive technological systems (such as large infrastructural technologies) as socio-technical systems (Mayntz 1988: 236). This approach rightly proposes that technology cannot be conceived as a social system. However, the conclusion which is drawn does not accommodate the abstract level on which my discussion is here located. Mayntz aims at a theoretical framework which illuminates empirical studies of specific technological infrastructure systems; my analysis tries to investigate relations between technological and social factors *per se*.

Several authors have emphasized the similarities between science and technology. One similarity is that both employ a method of decomposing (analysing) and recombining (see Price 1982). While this is obviously true, there is also a big difference. Consider the cases of a scientist and an engineer. The engineer will apply the scientific knowledge which he has learnt (his 'ambient knowledge' in the language of Price); but when it comes to the point where he has to solve a practical problem, he does not proceed in an essentially *scientific* way. It is not that intuition plays a greater role here than in science; rather, it is the fact that engineers can rest content with solutions they find *without asking for the exact scientific explanation*. Both scientific and technological activities are problem-solving, decomposing and recombining, but the engineer is concerned with a practical, workable solution whereas the scientist is looking for explanations on the level of his academic discipline. In the

⁴⁹ To avoid a possible misunderstanding: in denying the status of a social system to technology, one does not deny the decisive role of technology in modern societies.

⁵⁰ Or, in Habermas's earlier definition: '[W]e shall understand "technology" to mean scientifically rationalized control of objectified processes. It refers to the system in which research and technology are coupled with feedback from the economy and administration' (Habermas 1971b: 57).

words of Price, science produces papers, technology machines, drugs, products of any sort (see Price 1982: 170).

Consider now the distinction between system and environment. Technology stands in a close relationship not only to science, but also to economy and politics.⁵¹ Technology should be seen as part of the material world which has already been transformed by social labour into tools, instruments, machines.⁵² Technology contains a material and a social element, matter *and* mind. In Marx's formulation: 'Nature builds no machines, no locomotives, railways, electric telegraphs, self-acting mules etc. These are products of human industry; natural material transformed into organs of the human will over nature, or of human participation in nature. They are organs of the human brain, created by the human hand; the power of knowledge, objectified' (*Grundrisse* 706).

Scheler stressed that in modern societies science and economy are both autonomous social spheres: capitalist economy is driven towards limitless 'process of acquisition versus gaining and keeping of property' (Scheler 1980: 129; my translation). Likewise, science is expanding in a similar unlimited way: 'Modern science neither administers a given and stable asset of truth nor researches only to solve specifically defined tasks, but it is primarily a will to "methods" from which . . . emerges in a limitless way and unlimited process ever new substantive knowledge . . . almost automatically' (*ibid.*, my translation).

For my subject, a third social subsystem is relevant. This is politics. There have been some doubts whether politics deserves a special treatment within the social sciences. John Stuart Mill argued that there can be no such special science, since '[t]hose phenomena . . . with which the influences of the ethological state of the people are mixed up at every step (so that the connexion of effects and causes cannot be even rudely marked out without taking those influences into consideration) could not with any advantage . . . be treated independently of political

⁵¹ See Scheler 1980 for a model of a triple selection made by the scientist, the engineer, and the entrepreneur to which I want to add the political element. The scientist wants to construct all possible machines, the engineer all workable machines, the entrepreneur all profitable machines, and the politician all machines which enhance power and legitimation.

⁵² Marx presupposes *Naturstoff* which is transformed with the help of technology which is already transformed *Naturstoff*, see MEW iii. 45.

ethology' (Mill 1974: 906). This argument that politics cannot be studied separately since it is mixed up with the national character at every step is not very convincing, because the argument is not particular to politics—the same can apply to economics, too, for example: there are undoubtedly certain nationalities who can be said to have a greater business spirit than others. In contrast to Mill, Max Weber holds that modern politics in fact forms a separate field of human action which can be studied accordingly. In 'Politik als Beruf', Weber, similarly to Scheler, starts from an analogy to the economy as studied by Karl Marx. Both emphasize the analogy, but also that the respective fields are following unique laws of their own.⁵³ Above, we saw how Scheler defined the specific function of science in modern societies. Now, how does Weber define politics? According to him, 'engage in politics' means nothing else than 'seek to influence the distribution of power within and between political structures' (Weber 1948: 83). How is this political realm defined? Weber describes it in similar terms to the functioning of a capitalist enterprise:

[T]he modern state controls the total means of political organization, which actually come together under a single head. No single official personally owns the money he pays out, or the buildings, stores, tools, and war machines he controls. In the contemporary 'state'—and this is essential for the concept state—the 'separation' of the administrative staff, of the administrative officials, and of the workers from the material means of administrative organization is completed. (ibid. 82)

Although sketched very roughly, these systemic distinctions are the ground on which later versions of social theory could find a point of departure for their functional and systemic approaches. In what follows, I shall take Luhmann's theory as a major reference point when discussing the differentiation of society into subsystems, and the interrelations between them. In his theory, politics is that functional subsystem of modern society in which collectively binding decisions are taken (see Luhmann 1988d: 29–30).

⁵³ Weber says: 'The direction of capitalist enterprises, despite far-reaching analogies, follows quite different laws than those of political administration' (Weber 1948: 82).

As we shall see in a moment, the most convincing solution to the problem of distinguishing system and environment is to attribute everything which is not part of the system to the environment. Thus each of these systems conceives all other systems *and* the environment (such as technology and natural resources) as its environment. Note that economy, politics, or science have to take into consideration the characteristics of existing technology. This may influence the systemic behaviour in many ways. Consider: politics is confronted with dangerous technologies as a problem of legitimation; economy is keen on certain most profitable technologies; scientific research is dependent on technological apparatus and research funds.

Usually the production of technology itself is conceived of as an economic activity, that is, *firms* are concerned with the construction of new technologies. Economic activity is seen as including technological activities, or, to put it the other way round, technology is a special case of economic activity.⁵⁴ Although this is a rather crude and narrow version of the social dimension of technology, it may serve the purpose of illustrating a 'technological trajectory'. A reason for such a 'technological trajectory' is the role of fixed capital. As Hughes put it,

The durability of artifacts and of knowledge in a system suggests the notion of trajectory, a physical metaphor similar to momentum. Modern capital-intensive systems possess a multitude of durable physical artifacts. Laying off workers in labour-intensive systems reduces momentum, but capital-intensive systems cannot lay off capital and interest payments on machinery and processes. Durable physical artifacts project into the future the socially constructed characteristics acquired in the past when they were designed. (Hughes 1987: 77)

Consider now the enlarged view: here we have scientific, economic, and political factors shaping technology. Additionally, a new technology must be a technology which fulfils certain standards of engineering. A new technology thus has to be in accordance with politics, science, economics, and engineering. Apart from the fact that technology is durable, the development of new technologies takes time; we therefore have a certain inertia of technological development. It is unlikely that all the

⁵⁴ As Max Adler (1964: 32, my trans.) put it: 'Economy and technology are by no means two distinguished factors which could act upon each other. They are but two sides of one process, and this is the social life- and working-process ...'

time technologically revolutionary 'shocks' occur. Quite on the contrary, it is likely that a process of diffusion and saturation occurs.⁵⁵

Piore and Sabel try to explain both technological trajectories and historical turning-points. Their 'possible worlds approach'⁵⁶ may be seen as akin to the 'social construction of technology' approach when they stress that there is no 'absolute best technology': 'Thus although the winning design had to meet some minimum performance standard, the sweep of its success was not a proof of unrivaled technical superiority, nor of the existence of a narrow track of progress: other variants could have served as well. Power in the market, not efficiency (in the sense of a uniquely appropriate application of technology) decided the contest' (Piore and Sabel 1984: 40). Once a breakthrough has been made, many competitors choose to follow a proven approach 'rather than risk failing to find one more suited to their needs' (ibid.). From this the authors conclude that 'in the world of possible worlds, relatively short periods of technological diversification punctuate longer periods of uniformity. The technical knowledge that is accumulated during the interludes of diversity creates the possibility of divergent breakthroughs: branching points. At these technological divides, the different political circumstances in different regional or national economies move technology down correspondingly different paths' (ibid. 39). Thus they suggest the metaphor of a branching tree instead of classical Political Economy's 'narrow track' when considering the history of technology.

If we now confront Marx with the results of this section, two things require comment.

1. At first sight it seems that Marx was a follower of classical Political Economy's 'narrow track' rather than a proponent of the possible worlds theory, as when he presents the development up to the machine as a logical development, one which follows an inner logic. This is clearly expressed in the passage from the *Poverty of Philosophy* where he sketches the various stages of

⁵⁵ Economists call this 'absorbing Markov processes'. I shall return in ch. 4 to the problem of 'stasis'.

⁵⁶ This approach has been developed by Stalnaker and Lewis (and before them, of course, by Leibniz). For a good discussion of the theory with respect to economic history, see Elster 1978. See also the critical remarks by Lukes (1980).

development from tools to the machine. (See *CW* vi. 186–7; quoted above, p. 110). But at the same time Marx is aware that the history of technology has not yet got the attention it deserves. In *Capital*, he suggests a historical investigation into technology which would proceed by analogy to Darwin's investigation of natural history (see *Capital* i. 352). However, an evolutionary view of technology, especially if based on Darwin's method, will leave no room for any teleological explanations.⁵⁷ Now what about the 'inner logic' of specific technologies? I think that such an 'inner logic' and an evolutionary view of technology may be compatible. With respect to biological evolution one can say that although it is a non-teleological process, it can nevertheless be *interpreted* as if it were a teleological process (cf. Habermas 1976a: 187; one could call it 'teleonomic'). If we apply this argument to technology, we might say the same: although the development of technology is a non-teleological process, we can look at it with hindsight and try to find the mechanisms which stabilized such improbable constellations. Looking at the history of technology, we as observers impose some preconceptions about order, 'and this preconception then allows the observer to watch the changing instances, compare them, and see whether there is a progression toward orderliness in those portions being observed. If there is, evolution has occurred' (Weick 1979: 119).

2. It seems clear that Marx is aware of both economy and science as interacting factors. However, he overestimated the science–technology interaction, in comparison to political influences upon technology. The latter seem to have only an indirect influence, via laws which are the result of class conflicts.⁵⁸ With respect to communist society, he stressed the important role of science and economy, too. The necessity of scientific understanding has already been indicated; the importance of economic criteria is expressed clearly in *Capital* iii:

[A]fter the abolition of the capitalist mode of production, but still retaining social production, the determination of value continues to prevail in the sense that the regulation of labour-time and the distribution of social labour among the various production groups, ultimately the

⁵⁷ Marx is aware of this, see the already cited letter to Lassalle, 16 Jan. 1861.

⁵⁸ He stressed that the law which shortened the working day enhanced the development of technology. See *Capital* i.

book-keeping encompassing all this, become more essential than ever. (*Capital* iii. 851; see also *Capital* ii. 137–8)⁵⁹

Here science is in a close relationship with economy, but at the same time has a certain autonomy. The economy tries to utilize, and even direct, scientific knowledge; but science is not merely demand-induced. Science must have developed before, and independently from, capitalism (*Capital* i. 434, 567; see also Rosenberg 1976b: 135–6).

3.3.1. Criticisms: system and environment

In contrast to the above-mentioned model of a 'technological trajectory', several authors have developed a different approach. Pinch and Bijker (1987) speak of a 'multidirectional development of technology'; Callon (1987) assumes an 'actor-network' which contains animate and non-animate components; Law (1987), in a similar vein, coins the notion of 'heterogeneous engineering'; van den Belt and Rip (1987) assume a 'nexus' between technological trajectory and the selection environment (which they see embodied in patent law in an exemplary way). All these concepts try to avoid what the authors think to be an inherent difficulty of evolutionary theory: the distinction between system and environment.⁶⁰ As Callon rightly states: 'The systems concept presupposes that a distinction can be made between the system itself and its environment' (Callon 1987: 100).⁶¹ But 'how do we define the limits of a system and explain concretely the influence of the environment?' (ibid.). The main difference from Darwinian systems is seen in the fact that in the case of technology the selecting criteria are not just given, but socially shaped. Van den Belt and Rip make this point following Elster (1984: 6): 'In biological evolution, although mutations are random, the selection process is deterministic; that is there are "well

⁵⁹ Recall Weber 1978: 103 as cited in s. 1.3.

⁶⁰ From this basic assumption follow the different attempts to resolve the problem: whether 'nexus', 'actor-network', or 'heterogeneous engineering', all try to dissolve the boundaries between system and environment.

⁶¹ The theoretical problems which the authors pose themselves thus arise from a misconception of technology: only if one tries to define technology as a social system does the difficulty of distinguishing system and environment arise. Yet another consequence follows from some of their approaches: those who think that technology cannot be regarded as a social system seem to reject systems theory *tout court* (Mayntz is an exception in this respect).

defined criteria for accepting or rejecting any given mutation." (Elster). In societal evolution involving technological development, even the selection process is far from deterministic: 'Intentions and expectations play a role' (van den Belt and Rip 1987: 140–1). In other words: actors try to change the actions of others and thereby change their environments. 'Thus the assumption of a selection environment that is truly independent of a particular technological trajectory is hard to justify' (ibid.). Against this argument three points can be made:⁶²

First, if we take into account unintended consequences of human action, we cannot assume strategic action to be always successful (see Douglas 1986). In this case we again get blind events, which can be studied from an observer's standpoint with the help of evolutionary models.

Second, there are inherently technical factors which determine a special course of development in some cases. We can illustrate this point again with an example from biology. As Gould has pointed out, 'Galileo argued that the bone of a large animal must thicken disproportionately to provide the same relative strength as the slender bone of a small creature . . . This simple principle of differential scaling with increasing size may well be the most important determinant of organic shape. J. B. S. Haldane once wrote that "comparative anatomy is largely the story of the struggle to increase surface in proportion to volume". Yet its generality extends beyond life, for the geometry of space contains ships, buildings, and machines, as well as animals' (Gould 1973: 173–5). Gould then presents medieval churches as a testing ground for the effects of size and shape. There are inherent barriers for the size of a church, because

the area of outer walls and windows would increase as length cubed. In other words, the area of the windows would increase far more slowly than the volume that requires illumination . . . Large organisms, like

⁶² As I pointed out in s. 3.1.2, there is an important difference between biological evolution on the one hand and social and technological evolution on the other. This difference lies in the different speed of development and the higher capacity of the social field to recombine its elements in innumerable ways. Evolution of biological species is a relatively slow process which leads to specialization of natural characteristics. Evolution of social forms and of technologies is a relatively fast process of differentiation and recombination of elements. The last aspect thus deserves our special attention (see Luhmann 1984a: 569; Tiezzi 1984; and see ch. 5).

large churches, have very few options open to them. Above a certain size, large terrestrial animals look basically alike—they have thick legs and relatively short, stout bodies. Large medieval churches are relatively long and have abundant outpunchings. The 'invention' of internal organs allowed animals to retain the highly successful shape of a simple exterior enclosing a large internal volume; the invention of internal lighting and structural steel has permitted modern architects to design large buildings of essentially cubic form. The limits are expanded, but the laws still operate. (Gould 1973: 175–7)⁶³

This may be an illuminating illustration when discussing the question of technological autonomy or technological trajectories. A small car probably cannot be a large car writ small; neither can the opposite obtain. In ignoring this, the Ford motor company had to suffer an unpleasant experience:

The troubles that the Ford Motor Car Company had in the 1930s producing a compact car suggest that some of their problems resulted from the fact that they presumed small cars are made the same way as large cars: take a big car and shrink it. Since Ford knew how to make large cars, they thought there was no problem. (Weick 1979: 6)

But even if technology develops in accordance with the laws of size and shape, it eventually arrives at a halting point. To advance technology, new technological solutions must be available. On such a reading, one can derive a dynamic model of technical change in which periods of simple extension alternate with periods of technical revolution. The first phase is characterized by extending existing technical principles (such as: bigger, smaller, faster, slower, lighter, heavier, more silent, more powerful, etc., see Rammert 1988). The second phase is characterized by a technical invention which helps to overcome a restriction, an obstacle to further development. There are several theoretical formulations of this problem, such as Hughes's 'reverse salients', or Rosenberg's 'bottlenecks'. Furthermore, there seems to exist an equivalent on the economic level in the law of diminishing returns (*Grenznutzen*) or in absorbing Markov processes: in these cases a point of saturation is reached, beyond which no further investment is optimal.

⁶³ As a schoolboy, I was always struck by the example that there are limits in length for a rope which is hanging freely. At a certain length it will inevitably break, because it cannot bear its own weight.

Third, all the approaches discussed above have one basic flaw in common: it is their anthropomorphic model of social action and evolution. Only by placing human action ('individuals') in the centre of analysis do they arrive at their conclusions. MacKenzie most clearly expresses this (mistaken) view when he writes: '[A]ctors create and maintain systems, and if they fail to do so, the systems in question cease to exist' (MacKenzie 1987: 197). And Hughes, on whom MacKenzie builds his argument, takes the same view in stressing the actor-dependent characteristics of technological systems: 'Because they are invented and developed by system builders and their associates, the components of technological systems are socially constructed artifacts' (Hughes 1987: 52). For this reason, 'the convention of designating social factors as the environment, or context, of a technological system should be avoided' (ibid.). But what if we reverse the two? Could we not imagine technology as part of the environment of social systems? I think this is the solution to the problem which, however, the authors under discussion here cannot allow for. Instead of treating technology as the environment of social systems, the heroic actions of individual 'system builders' must fulfil the theoretical blank in the analysis of technology.

Before going into greater detail on the question of evolution and systems theory (ch. 4), I shall keep attention for the remainder of this chapter on Marx's own analysis. Next I shall discuss Marx's alleged technological determinism (s. 3.4), the question of technological alienation (s. 3.5), and the division of labour (s. 3.6).

3.4. Marx: a technological determinist?

Discussing the question of technological determinism in Marx, we should first of all devote some attention to the problem of determinism in Marx *per se*.

Marx is often interpreted as an economic determinist. This interpretation holds that Marx's 'iron laws of history' rest on the paramount role of economic motives for social development. From the *German Ideology* where he sets up his research programme of investigating the 'life-process of the real individuals'

(CW v. 35) to his later Critique of Political Economy he is obsessed with the important role economic factors play in social life. A very clear expression of this view is the all-too-famous 'base-superstructure' metaphor. According to this model, it is clear that the economic base is far more important than the political, juridical, or cultural superstructure:

In the social production of their life, men enter into definite relations that are indispensable and independent of their will, relations of production which correspond to a definite stage of development of their material productive forces. The sum total of these relations of production constitutes the *economic structure of society*, the real basis, on which rises a legal and political superstructure, and to which correspond definite forms of social consciousness. The mode of production of material life conditions the social, political, and intellectual life process in general. It is not the consciousness of men that determines their being, but, on the contrary, their social being that determines their consciousness. (CW xxix. 263, emphasis added)

Nevertheless,⁶⁴ Marx was also a social determinist, for he believed that social institutions played a big part in explaining historical change. Thus, he did not concentrate on individual behaviour nor on economic relations 'as such'. Rather, his approach consisted in a specific conception of the social sphere which has its own dynamics. In this sense, Marx was a follower of Hegel; there was nothing strange in Marx suggesting that social institutions develop according to their own logic and their own goals: they are forms of objective spirit. It has been, and, perhaps, still is, fashionable to deride such an approach and to assimilate it to another Hegelian concept, namely the march of the *Weltgeist* through history. But if a rigorous attempt to explain decisive historical developments in terms of individuals' actions fails (and I think it does), then some kind of 'social determinism' will be needed, as developed by sociological theories, be they structural, systems, or functional approaches. In Chapter 2, I have analysed Marx's philosophical anthropology; we may label his intentions there as 'ethical individualistic'

⁶⁴ I need not conceal that in my view this metaphor is not very illuminating; on the contrary, it often obfuscates illuminating insights (see also Lukes 1983 for a critique). But it should also be said that Marx thereby formulated a problem which served as a starting point for sociological research. See only Weber 1930 and Mannheim 1936.

ones. But this normative dimension has to retreat when describing or explaining social reality. Marx was aware of this, as he made clear in the foreword to *Capital* i:

I paint the capitalist and the landlord in no sense *couleur de rose*. But here individuals are dealt with only in so far as they are the personifications of economic categories, embodiments of particular class-relations and class-interests. My standpoint, from which the evolution of the economic formation of society is viewed as a process of natural history, can less than any other make the individual responsible for relations whose creature he socially remains, however much he may subjectively raise himself above them.⁶⁵

Marx's social determinism is most clearly expressed in *Capital*. In respect of technology, his position is the following: machinery can be employed in completely different ways. Capitalism employs it to the detriment of the producers; communism will employ it to the benefit of the producers. Thus it is good *per se*, but bad under capitalist use. This offers him the theoretical possibility of achieving a social form which produces in a non-alienated way. Note that on the basis of a technological determinism such a perspective might be difficult. It would be difficult if the structure of technology were to impinge on a full development of human needs and capacities. The following passage from *Capital* iii can be read as confirmation for both the economic and social determinism:

The specific economic form, in which unpaid surplus-labour is pumped out of direct producers, determines the relationship of rulers and ruled, as it grows directly out of production itself and, in turn, reacts upon it as a determining element . . . It is always the direct relationship of the owners of the conditions of production to the direct producers—a relation always naturally corresponding to a definite stage in the development of the methods of labour and thereby its social productivity—which reveals the innermost secret, the hidden basis of the entire social structure, and with it . . . the corresponding specific form of the state. (*Capital* iii. 791)

⁶⁵ Many advocates of methodological individualism seem to confuse ethical and methodological individualism, to use a distinction of Lukes (1973). Or, as Teubner put it, they confuse moral-political options with theory constructions (Teubner 1989b). Many theorists seem to incur the fallacy of embracing an individualistic approach because they consider themselves humanists.

As I shall claim, Marx's central notions sometimes do not permit of precise differentiation between legal, political, and economic factors. The concepts 'relations of production' and 'productive forces' overlap; they cannot be defined independently of one another. In Chapter 4, I shall return to this issue, this time seen from the viewpoint of Cohen's claim that the productive forces have primacy over the relations of production, which is a technological determinist interpretation.

Turning now to Marx's technological determinism, we should first have a clear definition of technological determinism. If we define it in the strongest possible sense, it means that technology determines other social spheres (logical determinism) and that it is the driving force for social change (historical determinism).⁶⁶ On the first ('logical') level, we can distinguish between a strong and a weak notion. The strong notion would probably claim that to one specific technology, one social form which is determined by this technology exactly corresponds. The weak notion would probably claim that to a specific technology a variety of social forms may correspond, which consequently are thus not *determined* by technology; rather, they are 'allowed by' or 'compatible with' that technology. Marx sometimes invokes the weak, sometimes the strong notion. The weak version is present when he says that artisan technology was the technology of slavery and feudalism; the strong version is present when he says that capitalism is only capitalism when it is machine-based. However, the technological basis of capitalism (together with the co-operative character of the labour process) will also serve communist society, which again would suggest the weak version of the argument. It seems that an evolutionary approach requires the weak version, because all elements of a new social form must be already present at the prior stage and are always common to both social forms. I think that the strong notion cannot be supported in a consistent way. The evolutionary approach advises us to subscribe to the weak notion. The weak notion does not allow for any combination, it only rules out specific combina-

⁶⁶ MacKenzie thus refers to both meanings when he writes: 'To be a technological determinist is obviously to believe that in some sense technical change causes social change, indeed that it is the most important cause of social change. But to give full weight to the first term in expressions such as "prime mover" and "independent variable", it would also have to be believed that technical change is itself uncaused' (MacKenzie 1984: 474).

tions. We should thus take into consideration the possibility of functional equivalents (see Luhmann 1970). Marx, on some occasions, seems to forget his evolutionary approach because he cannot withstand the temptation to establish a rigid connection between technology and social form.

Turning to the historical dimension, we must note that Marx does not favour the technological argument. He says that both forces of production and relations of production are caught in an evolutionary development. There are examples of the importance of technological factors⁶⁷ as well as examples of the importance of social and political factors.⁶⁸

MacKenzie (1984) is also dealing with the question whether Marx can be called a technological determinist. Commenting on the 1859 *Preface* 'as the definitive statement of historical materialism', he writes:

Anything approaching a careful reading of it quickly reveals two things. First, to make it into a statement that machines make history, the 'forces of production' would have to be interpreted as equivalent to technology. Second, to make it into a strong technological determinism in the sense outlined above, the development of the forces of production would have to be taken as autonomous, or at least independent of the relations of production. (MacKenzie 1984: 476)

In my view, the first point causes no problems, since technology can be conceived as containing skills, knowledge, and experience.⁶⁹ More intriguing is the second question. G. A. Cohen has tried to make the second point in the strongest possible way, claiming that '(a) The productive forces tend to develop throughout history (the Development thesis). (b) The nature of the production relations of a society is explained by the level of development of its productive forces (the Primacy Thesis proper)' (Cohen 1978: 134). Furthermore, Cohen's intention is 'to use (a) as

⁶⁷ As when he holds that capitalism and communism cannot be based on artisan technology.

⁶⁸ As when he holds that only with the abolition of the guild laws and the consequent establishment of a labour market, only with the discovery of new continents and the import of precious metals (CW vi. 185) could capitalism grow up.

⁶⁹ Habermas overemphasizes these non-material elements of productive forces. He defines *Produktivkräfte* as consisting of (1) labour power; (2) knowledge which can be translated into productive techniques; (3) knowledge which organizes, mobilizes, and qualifies labour power. See Habermas 1976a: 152–3.

part of the argument for (b)' (Cohen 1978: 153). In other words, if technology can be shown to be the unmoved prime mover, MacKenzie's conditions would be fulfilled. I postpone the discussion of this point to Chapter 4, but nevertheless will make a judgement at this point: Marx did not employ technological determinism in a consistent way;⁷⁰ rather, he was tempted several times to use it as an additional argument for his theory.

3.5. Technological alienation

My suspicion in section 3.1.1 was that Marx runs into a theoretical difficulty when simultaneously endorsing an evolutionary approach towards technology and a normative humanist standpoint. Above, the two elements were made compatible by an interpretation which sees technological evolution as paralleled by an increase in human capacities. The total individuals were the result of an objective unfolding historical process, of 'blind' evolution. But what if this diagnosis is not plausible? The tension between the two elements turns into a contradiction if the historical and the critical level cannot be reconciled. If there was to be no technology which permitted the realization of Marx's humanist programme, he would have remained pessimistic. In fact, as we shall see, underlying his theory was optimism.

3.5.1. *Technological alienation in the Manuscripts 1861–3*

The aforementioned problem gives me a strong reason for locating technological alienation in Marx's discourse of the *Manuscripts 1861–3*. It is the character of the machine itself (and not its employment by capital) which expropriates his abilities from the worker, which transfers his skill to the machine.

Before going into greater detail, I first discuss briefly the notions of alienation, reification, and fetishism.⁷¹ The concept of fetishism derives from the Portuguese 'feitico' (Latin *factitius*) and means 'artificial', 'false', and 'magic'. It was first employed

⁷⁰ See Heilbrunner 1967 for a statement that Marx was an explicit technological determinist.

⁷¹ The term 'Verdinglichung' was first used in a systematic way by Lukács, who, in his early formulation, suggested an identity of 'Verdinglichung' and 'Entfremdung'. See his later self-criticism in the 1967 preface to *Geschichte und Klassenbewußtsein*. See also Petrovic 1983 and Geras 1983b for definitions.

in ethnology, but also in philosophy (Schelling, Hegel, Kant), sociology (Comte), physics, and psychoanalysis. It denotes the phenomenon of objects produced by people being invested with apparent power (cf. Seidel 1972). Objects do not have that power inherently, but the attribution of power to them by their producers generates their own power which is a real phenomenon. The fetish character of commodities arises because their social character is established only after the production, that is, after the use-values have experienced exchange and proved their exchange-value. According to Marx, if all labour were performed as social labour from the outset, there could be no fetishism. He refers above all to commodity, money, and capital fetishism; the first two he explains at the beginning of volume i of *Capital*; he returns to the third at several places throughout *Capital*, culminating in the 'Trinitarian formula' (volume iii).

In a passage in the *Grundrisse*, Marx links the concept of alienation quite tightly to the concept of fetishism. There he compares the function of money with the function of 'lists of current prices'. He says: 'Money . . . serves as such only because of its social (symbolic) property; and it can have a social property only because individuals have alienated their own social relationship from themselves so that it takes the form of a thing' (*Grundrisse* 160). Lists of current prices provide information about the activities of all others on the world market and are 'the best proof of the way in which their own exchange and their own production confront individuals as an objective relation which is independent of them' (*Grundrisse* 161). The three concepts reification, fetishism, and alienation can be seen here as forming the structure of a situation 'unworthy of human nature': (1) a social relation takes the shape of a thing; (2) this thing is invested with a power of its own; (3) this power reacts upon the individuals as an independent force. (1) stands for reification, (2) for fetishism, (3) for alienation. Marx here compares money and lists of prices with the result that (2) does apply to money but not to the lists of prices. From this Marx seems to conclude that the 'Aufhebung' of alienation is easier in the latter case. He writes: 'In the case of the world market, the connection of the individual with all, but at the same time also the independence of this connection from the individual, have developed to such a high level that the formation of the world

market already at the same time contains the conditions for going beyond it' (*Grundrisse* 161).⁷²

Consider, now, an application of this triad to technology. Obviously, (1) is not relevant here, since man's relationship to nature is nearly always mediated by things. The relation to nature is no social relation which then assumes the form of a thing, nay, it is already in the first place a 'dinghaft' relation, it is in its very nature characterized by the use of things. However, (2) and (3) are relevant, as we can see in every treatment of the matter by Marx.

According to Ricoeur, Marx in his *Paris Manuscripts* employed a Hegelian model when he analysed 'the inversion of human labour into an alien, foreign, seemingly transcendent entity. Therefore, the transformation by which the subjective essence of labour . . . is abolished and lost in a power that seems to rule human existence becomes the paradigm for all similar processes. Something human is inverted into something which seems to be exterior, external, superior, more powerful, and sometimes supernatural' (Ricoeur 1986: 35).

Ricoeur rightly insists that—in contrast to the dogmatic Marxists—there is no fundamental *economic* alienation from which all other forms of alienation are derived; rather, these other alienations are analogical to the Feuerbachian construction (see *ibid.* 36). Consider, for example, Marx's description of money-fetishism:

Their power [of gold and silver] appears as a kind of fate, and the consciousness of men, especially in social orders declining because of a deeper development of exchange-value relations, rebels against the power which a physical matter, a thing, acquires with respect to men, against the domination of the accursed metal [*verfluchtes Metall*] which appears as sheer insanity. (CW xxix. 487)

If Marx's enterprise is characterized by a strong anthropocentric and critical approach, this must inevitably be in opposition to

⁷² Cf. Keynes's drastic statement which may serve here to make the distinction between two different uses of money clearer. Writing about a future society, he says: 'We shall be able to afford to dare to assess the money-motive at its true value. The love of money as a possession—as distinguished from the love of money as a means to the enjoyments and realities of life—will be recognised for what it is, a somewhat disgusting morbidity, one of those semi-criminal, semi-pathological propensities which one hands over with a shudder to the specialists in mental disease' (Keynes 1972: 329).

the 'machino-centric' description of capitalist reality of production.⁷³ Marx, however, does not care to show how an *Aufhebung* of this contradiction is possible, how a new, socialist 'machine' can be imagined. Following the 'materialist' advice of Marx, this new 'machine' would still have to emerge under the old conditions, i.e. in capitalism. Yet, he himself does not show this and he gives us no touchstone at all to indicate that it should occur. We can only presume that he aims at a similar thing when he writes:

Capitalist production is generally characterized by the fact that the means of production oppose the living labourer in an independent way, as if they were personified. The worker does not employ the means of production, but vice versa. By this reversal the workers become capital and the commodity owner who employs them becomes capitalist. (MEGA II. iii. 6. 2014)

According to this outline, a post-capitalist society would be a society in which the workers employ the means of production ('im Accusativ anwenden', as Marx says—instead of vice versa, as in capitalism). The creation of a new social form (=abolishing of capital) is accompanied by a new technological form (=abolishing of enslaving work). Marx aims at overcoming these 'contradictory forms' of social production: 'As soon as this contradictory form falls away it follows that they possess this means of production socially, not as private individuals' (MEGA II. iii. 6. 2144).

Since technology in capitalism assumes the form of fixed capital, two things exert domination over the worker: capital

⁷³ Heidegger's position can be interpreted as a straightforward position of technological alienation. The 'essence' of modern technology, according to him, can be understood neither in terms of instrumentality (means–ends relationship), nor in terms of human activity. The essence of modern technology is rather that it is concealing instead of revealing. '[M]odern technology does not unfold into a bringing-forth in the sense of *poiesis*. The revealing that rules in modern technology is a challenging [*Herausfordern*], which puts to nature the unreasonable demand that it supply energy which can be extracted and stored as such' (Heidegger 1978: 296). Nature becomes an object of ordering, a 'standing reserve'. Even man is involved in this process, although he is never 'transformed into mere standing reserve. Since man drives technology forward, he takes part in ordering as a way of revealing' (*ibid.* 300). This is not the place to deal with the exact structure of Heidegger's argument; suffice it to say that, for him, '[m]odern technology, as a revealing which orders, is thus no mere human doing' (*ibid.*).

and technology. Capital and machinery in their evolution and in their functioning are acting in pairs, reinforcing each other, conditioning each other. The one is not possible without the other. It takes only a small step for Marx to assume that the *Aufhebung* of the capital-labour relation would also lead to an *Aufhebung* of deskilling machinery. But Marx does not devote any discussion to this special problem. He only states in a very general way that workers in post-capitalist society will possess the means of production socially, not as private individuals (cf. *MEGA* II. iii. 6. 2144).

In the *Manuscripts 1861–3*, Marx is a technological determinist when backward-looking and a social determinist when forward-looking. In *Capital*, Marx tries to get out of these theoretical difficulties and gives the following solution: his argument builds exactly on the 'social character of labour'. He claims that in capitalist modern industry the character of labour is immediately social and co-operative; all that needs to be done is the expropriation of capital. The advantage of this solution readily springs to mind: it is consistent with his evolutionary approach ('new productive forces do not drop from the sky', *Grundrisse* 278), and at the same time fits his normative criteria. Only in this way could he bring together the historical and critical strands of his project. We may thus say that although his approach in *Capital* is far more 'social determinism', he nevertheless allows for a technological argument, too. This occurs when he claims that the social institutions have to adapt to the 'technical necessity' (*Capital* i. 365) of the labour process.

3.5.2. How Marx changed his view: Manuscripts 1861–3 v. *Capital*

The degree to which Marx maintained this definition of the machine and its corollaries in his final version of *Capital* is most interesting. One could show in great detail how he used the material from the *Manuscripts 1861–3* for the formulation of chapter 13 (15 in the English version) of *Capital*. But at first sight there seems to be a slight difference in the definition of the machine. In *Capital*, he defines it as follows: 'The machine . . . supersedes the workman, who handles a single tool, by a mechanism operating with a number of similar tools, and set in motion by a

single motive power, whatever the form of that power may be' (*Capital* i. 355).

Marx also repeats that the skill of the worker is transferred to machinery: 'Along with the tool, the skill of the workman in handling it passes over to the machine' (*Capital* i. 396). But the 'slight difference' turns out to be a radical cut between a machinery 'as such' and the really existing one (of capitalism). He cites Ure for the two different aspects of the automatic factory ('automatische Fabrik' as Marx calls the 'atelier' now). The first is "'[C]ooperation of many orders of workpeople . . . in tending with assiduous skill, a system of productive machines, continuously impelled by a central power" (the prime mover)' (*Capital* i. 394–5). The second is 'a vast automaton, composed of various mechanical and intellectual organs, acting in uninterrupted concert for the production of a common object, all of them being subordinate to a self-regulated moving force' (*Capital* i. 395).

Now look at Marx's comment: 'The first description is applicable to every possible employment of machinery on a large scale, the second is characteristic of its use by capital, and therefore of the modern factory system' (*Capital* i. 396). But this distinction is completely artificial, having no real basis in the text of Ure. Marx has nowhere shown what 'every possible employment of machinery on a large scale' could mean. Additionally, the first passage of Ure in support of a 'neutral' use of machinery is self-defeating. Here it is clearly expressed that the workers only oversee (*überwachen*) a system of productive machinery. No virtuosity is inherent in the workers, as Marx himself asserts on the next page. He says: 'Hence, in the place of the hierarchy of specialised workmen that characterises manufacture, there steps, in the automatic factory, a tendency to equalise and reduce to one and the same level every kind of work that has to be done by the minders of the machines' (*Capital* i. 396). Marx could not rest content with such a perspective. Communism would have to abolish the reduction of workers into mere 'appendages' to machinery. Marx, however, is a materialist. He could neither be content in proclaiming such a goal for communist society nor advocate a return to the medieval 'masterpiece' (see his polemic against Proudhon, *CW* vi. 190). He must show a real possibility for abolishing enslavement

in the production process which stems from technological factors.

It may be that Marx became aware, after the *Manuscripts 1861–3*, that he was trapped in the pitfalls of his own theory, for he had to provide a new technological 'elementary form' for post-capitalist society which must be already visible under present conditions. Since he could not provide this, he constructed it in a somewhat obscure way from Ure's text. Marx has two possible ways with which to defend his materialist programme:

1. he can claim that machines can be used in other than capitalist ways;
2. he can claim that under communism another technology will be used in the process of material production.

His strategy combines both points. He follows (1) in that he takes great pains to show how the liberating potential of machinery is not (and cannot be) set free under capitalism.⁷⁴ He develops (2) above all with respect to the character of the labour process (see s. 3.6).

The introduced distinction, however, has important consequences for Marx's further analysis in *Capital*; we can say that it changes the character of his discourse completely. It becomes the guiding thread for the remainder of the fifteenth chapter. We find a dozen passages like the following: 'Here as everywhere else, we must distinguish between increased productivity due to the development of the social process of production, and that due to the capitalist exploitation of that process' (*Capital* i. 398). Marx's strategy in chapter 15 is simple: he attributes all negative features of machinery (essentially those which oppose his theory of human nature) to the capitalist use; the positive features he attributes to 'Maschinerie an sich'.⁷⁵

Marx provides examples like intensification of work, child and woman labour, lengthening of the working day, etc. to prove the capitalist use. He stresses these features more than the

⁷⁴ The main point is the increased productivity which allows the producing of more output with a given portion of labour power. This means that the working day can be reduced drastically; and free time, we know with Marx, is important and left for the development of the individual, cf. *MEGA* II. iii. 1. 275; *MEGA* II. iii. 6. 1909–10, 2088–9.

⁷⁵ His evolutionary scheme thus anticipates a 'mutation' only of the relations, and the mode of, production, not of technology.

transfer of skill. It is no exaggeration to say that he actually substitutes the one for the other. The two, however, are of a different theoretical status. The first is *historical* (and thus contingent), the second *analytical*. The only analytical instance (in *Capital*) is the (spurious) 'Ure-distinction', the others are historical.⁷⁶ Now Marx seems to overemphasize the difference between the use of machinery by capital and the character of machinery as such. The expropriation of skill is no longer central, as it was in the *Manuscripts 1861–3*. To make it plain: if capitalists would refrain from using women and children in the production process, from lengthening the working day past its natural limits, etc. their use of machinery would nevertheless be capitalist (and not 'neutral' application of machinery 'as such'). Another instance of Marx's adherence to strategy (1) is the fact that machinery is used by capital as a tool for warfare against the workers. As Berg pointed out, 'Ure's automatic factory was the image of war' (Berg 1982: 201). Indeed, Marx himself was to use this parallel. He writes:

But machinery not only acts as a competitor who gets the better of the workman, and is constantly on the point of making him superfluous. It is also a power inimical to him, and as such capital proclaims it from the roof tops and as such makes use of it. It is the most powerful weapon for repressing strikes, those periodical revolts of the working-class against the autocracy of capital . . . It would be possible to write quite a history of the inventions, made since 1830, for the sole purpose of supplying capital with weapons against the revolts of the working-class. (*Capital* i. 410–11)⁷⁷

⁷⁶ Needless to say, the *Manuscripts 1861–3* abound with analytical examples: 'This is the big difference: whether the existing means of production confront the workers as capital and can be appropriated by them only in so far as they increase the surplus-value and surplus-product for their employers, that is, whether these means of production employ them or whether they, as subjects, employ the means of production in the accusative, in order to produce wealth for themselves' (*MEGA* II. iii. 3. 1195).

⁷⁷ See also the following passage from the *Manuscripts 1861–3*: 'All the more, here we have alienation in which the objective conditions of work (i.e. past labour) assume, *vis-à-vis* living labour, a direct opposition in that past labour, including the general social forces of labour, natural forces, and science, appear directly as *weapons*, partly to make workers redundant . . . partly to break their special qualifications and the claims which arise from them, partly to subjugate them to the factory despotism and military discipline of capital. In this form, therefore, the social conditions of work . . . appear not only as claims to the worker but as directly hostile and overwhelming powers which are employed in the interest of capital' (*MEGA* II. iii. 6. 2057–8).

This warfare, according to him, is no technological feature; rather, it is a social feature of class struggle, where capitalists use machinery as a weapon to become independent of special workers' skills. To repeat: this is the approach Marx adopts in *Capital*. In the *Manuscripts 1861–3*, however, he additionally defines the conflict as one between the 'iron man' and the man 'of flesh and blood':

Also here, past labour—as automaton and the machinery moved by it—appears as independent of labour and self-acting, instead of being subjected to it, is subjecting. It is the *iron man* which opposes the man of flesh and blood. This subjugation of his labour under capital . . . which is given with capitalist production appears here as a technological fact. The *corner-stone* is in place. Dead labour is endowed with movement and living labour is only one of its conscious organs. (MEGA II. iii. 6. 2057–8, my emphasis)

This passage echoes again a formulation of Ure, who wrote in 1835: 'Thus the *Iron Man*, as the operatives fitly call it, sprang out of the hands of our modern Prometheus at the bidding of Minerva—a creation destined to restore order among the industrious classes, and to confirm to Great Britain the empire of art' (Ure 1967: 367, cited in Berg 1982: 201).

Though Ure says that '[t]he news of this Herculean prodigy spread dismay through the union, and even long before it left its cradle, so to speak, it strangled the Hydra of misrule' (ibid.), this does not stand up to closer scrutiny. As Lazonick (1979) has shown, the shop-floor organization continued even after the introduction of the self-acting mule. This is affirmed by the following account of Piore and Sable:

In 1830 . . . the Manchester engineering firm of Sharp, Roberts & Company introduced the self-acting mule, and promised its customers that the new equipment would allow the substitution of unskilled machine operators for skilled cotton spinners—thus putting an end to the spinners' union in the mills. Ure, a political economist and industrial consultant, popularized this claim as a statement of fact; Marx (who called Ure the Pindar of the factory) accepted this account and, as we saw, made it a starting point for his reflections on the decisive role of special-purpose machinery in modern industry. Yet the cotton spinner's role in production—part supervisor, part recruiter of labor—was far more complex, and management's grip on the shop-floor activity far more limited, than the machine maker, the consultant, and the theorist

imagined. The spinners' (now called minders') union not only survived but gained extensive control over the use of the new technology. (Piore and Sable 1984: 45)

However, the above quote from the *Manuscripts 1861–3* also reveals that Marx discerned alienation on the technological level alone. This comes out when he uses the term *Frontstein* (keystone, corner-stone), which brings to mind architecture. The picture is of an arch which is completed by a keystone. This keystone prevents the construction from collapsing and provides its stability. The worker gets expropriated of his skills and of his product; it is capital which accumulates both and represents itself as the living subject: dead labour which is able to move on its own; living labour which serves only as an appendage to it.

The increase in productivity which stems from the division of labour . . . is not only a productive force of capital instead of the worker. The social form of these combined activities is the existence of capital against the worker. This combination confronts the worker as an overpowering force to which he succumbs since his labour has been reduced to a wholly one-sided function which counts for nothing in separation from the whole mechanism. The worker himself has become a mere detail. (MEGA II. iii. 1. 254)

'In machinery . . . the domination of past labour over living labour gains not only social . . . but also technological truth' (MEGA II. iii. 6. 2059). This passage contains in a nutshell both technological determinism and an analysis of technology in terms of fetishism—a position which Marx in *Capital* is going to blur.

3.6. Alienation and the division of labour

The concept of 'division of labour' has had a long career from ancient Greek philosophy to the Political Economy of Marx's time. It is essentially a concept which lacks precision since every author and every epoch uses it in a different way. Authors who, like Marx, try to use the concept to cover many phenomena are thus easily confused in their argument.

In fact, the concept 'division of labour' is a rather complex subject in Marx too; it is used in different ways, which sometimes leaves the reader confused. Marx himself was aware of

this danger when he criticized Proudhon for using the concept 'division of labour' in such a vague way. Marx's point was that the concept covers too many different things which do not have much in common and thus can hardly be understood by the term 'divide' (cf. *CW* vi. 180).

But why, then, am I interested at all in the concept and especially its connection with technology? Both technology and the division of labour are essential for Marx's discussion of the 'good society', i.e. for his communist perspective. Both technology and division of labour in communist society must be of a kind that exerts minimal 'enslaving effects' on individuals. But both are, on the other hand, main 'agents' in the development of the preconditions for a communist society. They develop possibilities of transport and communication (world market), reduce the socially necessary labour, lead to an increase in productivity: in short, they contribute to the creation of *real wealth*. But they do not bring about this real wealth completely; all they do under capitalist relations is produce material wealth ('sachlicher Reichtum'), and this only in antagonistic forms (class domination, poverty, economic crises, etc.). Marx's concept of division of labour has—like his concept of technology—a historical and critical dimension (for a comprehensive discussion, see Grundmann 1988).

As Fetscher noted, Marx in his mature works 'no longer pretends that the division of labour will altogether disappear. Certainly there will be different social functions and people to fill them.' And, Fetscher continues, 'the very nature of modern industrial production and the rapid change of its technology will demand many more many-sided individuals' (Fetscher 1973: 461). Marx thought that the development of modern industry and the development of human needs and capacities would go together. This connection is established in the following way: '[P]rivate property can be abolished only on condition of an all-round development of individuals, precisely because the existing form of intercourse and their existing productive forces are all-embracing and only individuals that are developing in an all-round fashion can appropriate them i.e. can turn them into free manifestations of their lives' (*CW* v. 439; see also *CW* v. 86 ff.). In *Capital* i, Marx similarly points out that 'modern industry through its catastrophes imposes the necessity of recognizing,

as a fundamental law of production, variation of work, consequently fitness of the labourer for varied work, consequently the greatest possible development of his varied aptitudes' (*Capital* i. 458). Here Marx explains in a functional fashion that human abilities have to adapt to productive necessities. This argument, however, presupposes a gap between the development of productive forces and *individual* abilities. Thus, Marx tacitly assumes that mankind's collective objectifications (such as technology) evolve in a different manner, at a different speed, or at a different rhythm from individual capacities. Since both are tied together by functional requirements, they co-evolve. This leads Marx to the enigmatic statement that mankind sets itself only tasks which it is able to fulfil (1859 *Preface*).

It seems plain that Marx would allow for a certain social division of labour, as far as it is the product of the associated individuals.⁷⁸ Heller summarized Marx's intention very well: 'Marx attacks those theoreticians who tie the specialisation which arises from centralisation to capitalist relations of production, "as if the division of labour were not *likewise* possible if its conditions belonged to the associated workers, and were regarded by the latter as their own activity, which they are by their very nature"' (Heller 1976: 108; Marx quotation from *Theories of Surplus Value*, cf. *MEGA* II. iii. 4. 1405). Heller contends that the bourgeois economists want to achieve by this identification a justification for the capitalist mode of production. As Marx put it, they seek 'a technological justification for the specific social form, i.e. capitalist form, in which the relationship of labour to the conditions of labour is turned upside down, so that it is not the worker who makes use of the conditions of labour, but the conditions of labour which make use of the worker' (cited in Heller 1976: 108; cf. *MEGA* II. iii. 4. 1409).⁷⁹

Marx was ambiguous in evaluating the division of labour in modern industry. He regards it in both positive and negative terms. It is positive, since it contributes to the increase in productivity and thus contributes to the material preconditions for

⁷⁸ Selucky in his (otherwise illuminating) treatment of the division of labour is thus mistaken when he says: 'Be that as it may, Marx and Engels wanted to abolish the division of labour' (Selucky 1979: 10).

⁷⁹ Cf. also Habermas's claim that technology in late capitalism takes the form of ideology, since 'Sachzwänge' are blamed instead of obsolete power relations. See Habermas 1971b: 59.

communist society. It is negative since it contributes to enslaving effects, that is, individuals get subsumed under a life-long task which hinders their development into 'total' individuals.⁸⁰ Now, it would be naïve to think that communism could do away with the division of labour because the necessary levels of material wealth would then exist. The reproduction of wealth requires a certain social organization of labour, which may be called 'division of labour'. From this it follows that communist society also must develop a social form of division of labour, but one which exercises no enslaving effects.⁸¹ Unfortunately, Marx dedicated little attention to the topic of division of labour in society. It seems that he would see an inverse relationship between the division of labour inside the factory and the division of labour in society: the less division of labour inside the factory, the more division of labour in society.⁸² My conjecture is that he does see the trend towards a functionally differentiated society, which, however, will be reversed at a certain stage of historical development. As Elster rightly pointed out, 'like Weber and Durkheim, Marx . . . saw the progress of history up to the present as one of constant differentiation. Unlike them, he did not see this as an irreversible process, but predicted that there would occur a final stage of integration, or loss of differentiation' (Elster 1985: 113).

If Marx's main interest was to reduce the fragmentary effects of the division of labour, a prerequisite thereto was the exploration of the possibility. From the *Grundrisse* onwards, Marx assumes

⁸⁰ In *Capital* i. 343 Marx cites Urquardt with approval: 'To subdivide a man is to execute him, if he deserves the sentence, to assassinate him if he does not . . . The subdivision of labour is the assassination of a people.'

⁸¹ Both in the early *German Ideology* and in the *Critique of the Gotha Programme* of 1875 Marx explicitly assumes separate 'social functions' to exist in a communist society. See *CW* v. 47; *SW* iii. 19, 26; see also *Grundrisse* 158.

⁸² Actually, the place where this quote occurs deals with manufacture but I think it fits the stage of machinery as well: 'The division of labour in the workshop implies concentration of the means of production in the hands of one capitalist; the division of labour in society implies their dispersion among many independent producers of commodities . . . [I]n a society with capitalist production, anarchy in the social division of labour and despotism in that of the workshop are mutual conditions the one of the other' (*Capital* i. 336–7). Capitalist society is only able to organize its tasks with the help of despotism and anarchy which to Marx must have appeared a very undesirable state of affairs.

a natural division of labour which is based on personal endowments and geographical and climatic factors (*MEGA* II. iii. 1. 266–7) and an occupational, professional division of labour which found its most adequate expression in the system of manufacture. Modern industry destroys this division of labour and leads to a form of co-operation.⁸³ Marx's political perspective is to regulate this co-operation socially⁸⁴ and to allow for an all-round education and training of the whole working population (*Capital* i. 458). He refuses to return to the idea of the craftsman, as Ricoeur pointed out:

For Marx, we must push the industrial system to its last consequences in order to achieve a solution at the level of the illness. The nostalgia of romantics for an earlier labour situation is thus misplaced. The craft worker who made a complete work still did not control the market; the value of the work was determined by someone else. (Ricoeur 1986: 53)

Marx strongly opposed a life-long subordination of individuals to specialized tasks in all of his works; in other words, he opposed a fusion of occupational and technical division of labour. The division of labour within society is, however, a broader concept than the division of tasks: the occupational division of labour is only one part of the social division of labour.

Marx's ambiguity in evaluating the division of labour is resolved by means of a change in opinion on these matters. In the preparatory writings to *Capital*, he depicts the difference between manufacture and modern industry in the way that the period of manufacture leaves the virtuosity and skill with the worker, whereas in modern industry the worker gets deprived of his virtuosity and skill. Whereas the division of labour in manufacture was a real *division of labour*, a division between different sorts of labour (*MEGA* II. iii. 1. 269–70),⁸⁵ in modern industry

⁸³ According to Marx the concept of co-operation is the universal form of which the division of labour is only a special case: see *MEGA* II. iii. 1. 229–31.

⁸⁴ Cf. *Capital* i. 400: 'The factory code . . . is but the capitalist caricature of that social regulation of the labour-process which becomes requisite in cooperation on a great scale, and the employment in common, of instruments of labour and especially of machinery.'

⁸⁵ It is concentration instead of dispersion of the elements of the production process which is characteristic of manufacture. Marx therefore calls manufacture the mode of production specifically corresponding to the division of labour [see *MEGA* II. iii. 6. 270].

there exists a *division of machines*, under which living labour is subjected (MEGA II. iii. 6. 2016).

Simple co-operation and division of labour get totally transformed once machinery becomes the main way of producing:

Now we come to the mechanical atelier which is based on a system of machinery. To be sure, here we also have a division of labour . . . It has its material basis in the different, specific machines . . . In this mechanical atelier the body of the whole mechanism consists of the differentiated machines themselves . . . Here it is not a specifically developed labour power which uses particular instruments like a virtuoso does, but it is the self-acting instrument which needs specifically and constantly attached servants. (MEGA II. iii. 6. 2020)

In the system of manufacture, the tasks are distributed according to a hierarchy of skills and powers. Specific physical and mental abilities of individuals are seized upon and developed in their one-sidedness in order to produce a common, general mechanism (cf. MEGA II. iii. 6. 2020). By contrast, in modern industry⁸⁶ there no longer exists a hierarchy of abilities. What we have is a general *nivellement* of services with the consequence that the workers can work at different machines with little prior training time (cf. *Capital* I. 396).

Under manufacture, the construction of new instruments had to be done with respect to human abilities and characteristics (MEGA II. iii. 1. 274). Modern industry, on the contrary, is characterized by the principle that machines get constructed under the sole influence of scientific analysis and natural laws. Marx echoes here a central theme from the work of Andrew Ure who stressed that machinery is preferable for factory-owners because it is not dependent on the skills of craft workers. Another point is that Marx repeats Ure's judgement that modern industry has eliminated the division of labour (see Berg 1982: 197–8).

Consider, now, the discussion in *Capital*. Marx repeats the general line of argument, but changes his evaluation completely: now he sharply criticizes the division of labour under the system of manufacture, drawing on Ferguson and Smith: '[The

⁸⁶ In the *Manuscripts 1861–3*, Marx often uses the term 'mechanical atelier' to denote the new technological character of the post-manufacture age. In *Capital* he calls it automatic factory, or, more generally, 'modern industry'.

division of labour in manufacture] increases the social productive power of labour, not only for the benefit of the capitalist instead of that of the labourer, but it does this by crippling the individual labourers' (*Capital* I. 344).

In manufacture, as well as in simple co-operation, the collective working organism is a form of existence of capital . . . manufacture proper not only subjects the previously independent workman to the discipline and command of capital, but, in addition, creates a hierarchic gradation of the workmen themselves. While simple co-operation leaves the mode of working by the individual for the most unchanged, manufacture thoroughly revolutionizes it, and seizes labour-power by its very roots. *It converts the labourer into a crippled monstrosity*, by forcing his detail dexterity at the expense of a world of productive capabilities and instincts; just as in the States of La Plata they butcher a whole beast for the sake of his hide or his tallow. (*Capital* I. 340, my emphasis)

Modern industry, on the other hand, is conceived positively: it is more productive than manufacture, since it is not dependent on a certain number of skilled craftsmen and their skills. Instead, an objective productive organism, a 'skeleton', takes their place. The 'subjective principle' of adapting the instruments to personal abilities falls away. The production process gets analysed in its constituent parts.

In manufacture, it is the workmen who, with their manual implements, must, either singly or in groups, carry on each particular detail process. If, on the one hand, the workman becomes adapted to the process, on the other, the process was previously made suitable to the workman. This subjective principle of the division of labour no longer exists in production by machinery. Here, the process as a whole is examined objectively, in itself, that is to say, without regard to the question of its execution by human hands, it is analysed into its constituent phases; and the problem, how to execute each detail process, and bind them all into a whole, is solved by the aid of machines, chemistry. (*Capital* I. 359)⁸⁷

The reversal of judgement thus seems to rely on a more positive view of the possibilities for human self-development offered by machinery. To illustrate the different character of the means of production, Marx uses the metaphor of 'dwarf-instruments'

⁸⁷ Cf. also *Capital* I. 456–7, 434, 567.

(*Capital* i. 361), as being characteristic of manufacture, whereas 'cyclopic machines', or even 'cyclopic monsters' (*Capital* i. 360, 364), are characteristic of modern industry. This indicates that, although monsters may be more horrible than dwarfs, neither is immediately preferable: dwarfs and monsters are both weird figures for humans.

Even more important is Marx's juxtaposition of the social character of labour in these two technological epochs. In manufacture the worker is expropriated of his skill which becomes in turn embodied in the *Gesamtarbeiter*:

Intelligence in production expands in one direction, because it vanishes in many others. What is lost by the detail labourers, is concentrated in the capital that employs them . . . In manufacture, in order to make the collective labourer, and through him capital, rich in social productive power, each labourer must be made poor in individual productive powers. (*Capital* i. 341)

We are wrong if we think that machinery also displays this feature since '[m]achinery . . . operates only by means of associated labour, or labour in common. Hence the co-operative character of the labour process is, in the latter one, a technical necessity dictated by the instrument of labour itself' (*Capital* i. 364–5).⁸⁸ This is the complete reversal of the argument in the *Manuscripts* 1861–3.⁸⁹ The decisive difference between the *Manuscripts* and *Capital* is the fact that according to the *Manuscripts* the worker under the system of manufacture is in full possession of his knowledge and skill, that it is he, *the human being*, who commands the instrument; modern industry, on the contrary, is

⁸⁸ The English translation does not render the following interesting connotation: the German original says machinery 'funktioniert nur in der Hand unmittelbar vergesellschafteter oder gemeinsamer Arbeit' (*Das Kapital* i. 407). Now, this is the same formula that Marx employs when describing a decisive feature of communist society, namely that labour would be social from the outset ('unmittelbar vergesellschaftet'), whereas in capitalism the social character of production proves itself only *post festum*, after the exchange of private products. It is no accident that Marx assimilates the character of work under modern industry to a feature of communist society.

⁸⁹ To avoid misunderstanding: in the *Manuscripts* 1861–3 Marx also emphasizes the point that machine production leads to higher productivity, and that the labour process becomes social. Large-scale production seems irreconcilable with single ownership of the means of production (cf. *MEGA* II. iii. 6. 2144). The fact that the workers are still fragmented, and developed only in narrow specialities, he considers to be an inheritance of manufacture, which is, however, enhanced by capitalist use of machinery (see *Capital* i. 398).

the most perverted form of capitalist technology (i.e. negative in comparison to manufacture). Marx reverses his judgement in *Capital*. He now conceives manufacture, as we have seen, as the technological regime which expropriates the workers from their skills, cripples their individualities, etc. Likewise, he conceives modern industry as a turning-point, as a mode of production in which the character of labour is already *unmittelbar gesellschaftlich*, 'co-operative'. The virtuosity, knowledge, and skills are embodied in the *Gesamtarbeiter*, albeit belonging to capital. On the basis of this construction it is sufficient to expropriate capital in order to return the lost capacities to the *Gesamtarbeiter*.

An additional point is of interest here. Marx said that the co-operative character of the labour process is a 'technical necessity' (see *Capital* i. 365). This suggests that he clings to a sort of 'technological primacy'. First develop technologies, then social institutions. This standpoint makes it easy to present the trend towards communism as 'inevitable', or 'lawlike'.

Technological determinism was a very appealing concept for Marx because it offered him the chance to prove the inevitability of communism. Every time he analyses the role of technology in history, he is tempted to endorse a determinist view, no matter whether we take the *The Poverty of Philosophy*, the *Manuscripts* 1861–3, or *Capital*. However, in the *Manuscripts*, Marx is left with the most discomforting theoretical problems when analysing the central role of machinery and its dehumanizing effects. Therefore, he makes little reference to the technological base of communism, which, after all, seems the most interesting question, given his evolutionary approach to technology and social institutions. In *Capital*, he solves this problem by stressing the co-operative character of the labour process as the decisive feature of modern industry, thus suggesting a 'genetic link' with communist society. This solution has the great advantage of presenting capitalism's technological base and organization of labour as being similar to those of communism. Using a distinction of Agnes Heller, we may say that Marx did not rely on the 'subjective will' to bring about a higher form of society; he was not content until he could find some 'natural laws' providing the possibility for transition.

4 Historical Materialism

All earlier modes of production were essentially conservative. (Karl Marx, *Capital*)

My discussion so far has shown that Marx's main critical concern was to investigate the conditions for realizing the 'good life'. To this end, he was interested in the liberating potential of technologies and social forms. Regarding technology, Chapter 3 explained that Marx was able to conceive of the problems which stem from man's dealings with nature. From this he did not conclude that it is the fault of technology as such or of a specific, dominating attitude towards nature. I think he was right to reject such a conclusion. Regarding social forms, he assumed that the negative aspects of technology only stem from its capitalist employment: in so doing I think he was wrong. He did not conceive of the possibility that specific forms of technology could cause ecological problems for every social form, not only for capitalism. This chapter will focus on the following questions. Starting from the premisses of historical materialism, its 'standard model', as laid out in the 1859 *Preface* and elsewhere, I try to reconstruct the basic underlying thought. As several discussions have shown, a reconstruction is needed since the original model is inadequate.¹ The underlying thought which should be kept is that society and technology can be analysed in evolutionary terms. Coevolution of social and technological forms is a process in which the individual has little explanatory power. My reconstruction thus tries to retain these Marxian analytical premisses, while simultaneously trying to overcome some of the basic flaws of the standard model.

When one speaks of coevolution, functional links between evolving units are required. This necessitates a brief consideration

¹ See the debate on G. A. Cohen's book (1978), especially the contributions by Elster (1980, 1982), Lukes (1983), Joshua Cohen (1982), Levine and Wright (1980).

of functional analyses in the social sciences. In section 4.1 I argue that social enquiry cannot do without functional analysis, that it is sound, and that it is, in some respects (depending on the questions one is asking), superior to causal-intentional explanation. In section 4.2 I try to apply findings of the emergent paradigm of *autopoiesis* to the problem of coevolution of society and technology. Section 4.3 tries to apply some findings of neo-Darwinian theory to the same problem. Section 4.4 summarizes Marx's presentation of how feudalism as a social form, based on a specific technology, was overcome by capitalism which was based on another technology. Section 4.5 confronts the basic claims of Marx's historical materialism with the ecological problematic, showing that its conclusion (the stripping away of private property relations) may be of little help when facing ecological problems, but that the potential of Marx's historical materialism is far greater than is expressed in the standard model.

Marx's interest in technology stems from his materialist approach to studying society. As he stated in *Capital*: 'Technology discloses man's mode of dealing with nature, the process of production by which he sustains his life, and thereby also lays bare the mode of formation of his social relations, and of the mental conceptions that flow from them' (*Capital* i. 352). In this statement, a relationship between three elements is expressed: (1) the transformation of nature; (2) forms of social relations; and (3) mental conceptions.² These three elements have been evident in Marx's work since the early *German Ideology*. In the canonical 1859 *Preface*, Marx states the following relationship between these elements:

In the social production of their life, men enter into definite relations that are indispensable and independent of their will, relations of production which correspond to a definite stage of development of their material productive forces. The sum total of these relations of production constitutes the economic structure of society, the real basis, on which

² As Douglass North put it: 'Marx's overall analysis, set in the context of economic history, explores human interrelationships as a vehicle for studying the increasing mastery of humans over nature. The growth of the productive forces of human beings was an ongoing process in the subordination of nature to man. As humans learned how to produce and use intermediate goods, it became necessary to define the relationship amongst human beings with respect to the production and use of these tools' (North 1986: 58).

risks a legal and political superstructure, and to which correspond definite forms of social consciousness. The mode of production of material life conditions the social, political and intellectual life process in general. It is not the consciousness of men that determines their being, but, on the contrary, their social being that determines their consciousness. At a certain stage of their development, the material productive forces of society come in conflict with the existing relations of production, or—what is but a legal expression for the same thing—with the property relations within which they have been at work hitherto. From forms of development of the productive forces, these relations turn into their fetters. Then begins an epoch of social revolution. (CW xxix. 263)

Let me concentrate on two aspects of this model only.

1. Marx conceives of the following three levels in bourgeois society:

- relations of production and productive forces, corresponding to each other (economic base), over which emerges a
- political and legal superstructure which, in turn, corresponds to
- forms of social consciousness.

2. Marx conceives of these three levels as standing in a relation of *determination* to each other: productive forces determine relations of production, these determine political and legal forms, which in turn give rise to a certain social consciousness. I shall propose to disconnect the various elements in the above model and to assign to them all an autonomous role. This means that technology, economy, law, politics, and culture are developing according to a logic of their own, without completely losing touch with each other.³ In other words, the proposal is a systems theoretical reformulation of the model contained in the *Preface* which would above all aim at a precise understanding of how productive forces, i.e. technology, are socially shaped. If it is technology which stands at the heart of the matter it is important to know what chances there are of bringing into existence technologies which are less harmful to the natural environment and to human beings. Only if we have

³ The reader will notice that I equate productive forces with technology, an equation which is basically true for capitalist societies. It seems that size and density of population played an equivalent role in pre-capitalist societies. With capitalism, it is clearly technology (see *Grundrisse* 400, 529).

an answer to this question can we reassess the question of whether mankind will be able consciously to control its own fate.

4.1 The spectre of functionalism

Before embarking in closer detail on the proposed reformulation of the premisses of historical materialism, I briefly discuss an important methodological question. The systems approach which I propose and the evolutionary approach which I shall examine later have a common reference point in functionalism. And functionalism also plays an important role in Marxism. As van den Berghe put it,

functionalism and the dialectic share an evolutionary notion of social change. For both Hegel and Marx the dialectic process is an ascensional spiral towards progress. The functionalist concept of differentiation postulates an evolutionary growth in structural complexity and functional specificity analogous to biological evolution. Admittedly, these two evolutionary views are different, and each presents serious difficulties. We are all aware of the pitfalls of organicism, the teleological implications of 'progress', and the untenability of assuming that evolution is unilinear or has an endpoint . . . Nevertheless, the convergence of the two theories on some form of evolutionism suggests that the concept of social evolution (in the minimal sense of change in discernible directions) may be inescapable. (van den Berghe 1963: 703)

Jon Elster argued that it is almost impossible to find functional explanations in the social sciences. According to him it is essentially a method which yields good results in biology, but obscures the issues at hand in the social sciences (Elster 1980: 125–6).⁴ This is so for the following reason: a functional explanation explains an event E as occurring because of its beneficial consequences for something else (X). Or, in his words:

An institution or a behavioral pattern X is explained by its function Y for group Z if and only if:

1. Y is an effect of X;
2. Y is beneficial for Z;

⁴ The target of Elster's criticism was G. A. Cohen's defence of historical materialism which employed a functional explanation. In order to avoid too exegetical an argument, I shall leave aside this debate here.

3. Y is unintended by the actors producing X;
4. Y—or at least the causal relation between X and Y—is unrecognized by the actors in Z;
5. Y maintains X by a causal feedback loop passing through Z. (Elster 1983b: 57)

Now Elster claims that having described the beneficial consequences and the occurrence of Y, we do not have an explanation at all, unless we can show the existence of a feedback mechanism which secures that Y will indeed occur. Elster affirms that no one has any quarrel with functional explanation where the mechanism is actually shown to be at work. However, 'the hard question is whether one can ever be justified in setting forward a functional explanation even in the absence of a specific mechanism. In biology this question is to be answered in the affirmative, because the general mechanism of natural selection creates a presumption that beneficial consequences explain their own causes' (Elster 1980: 126). According to Elster, social scientists unfortunately and typically do not satisfy all five conditions of the above list; and, typically, what is missing is the last condition.

Mary Douglas (1986) accepted Elster's demand, insisting at the same time that social sciences cannot do without functional explanations. In fact, she defends much of Durkheim's and Merton's programme, rejecting any naïve ('arm-waving') functionalism. G. A. Cohen took another line of defence when he claimed that there are always mechanisms at work, even when we are not able to show them (see Cohen 1980: 133–4). This epistemological point, however, offers us little resistance against bad functionalist arguments of the type 'whenever an event y has beneficial consequences it will occur'. I thus take sides with Douglas and Cohen in insisting on the importance of functional analysis for the social sciences,⁵ but also accept Elster's demand that in order to have a proper *explanation*, we need to provide some sort of mechanism. Elster concludes that social scientists should be committed exclusively to causal and intentional

⁵ And, especially, his insistence that game theory cannot replace the central assumptions of historical materialism. See also Berger and Offe: 'Logically, the game starts only after the actors have been constituted, and their order of preferences has been formed as a result of processes that cannot themselves be considered as part of the game' (Berger and Offe 1982: 525).

explanations in order to avoid obscure or pre-scientific results. Elster would be prepared to accept a functional analysis if the mechanisms at work could be shown. Otherwise, for him, it would have the status of a metaphysical notion, it would be obscuring matters rather than illuminating them.

From the structure of Elster's five conditions and his comments one can conclude that he regards functional explanation as a variety of causal explanation, since he ties cause and effect in a very tight manner.⁶ The only difference between a functional and a proper causal analysis would thus be the direction in which the causal chain is running.⁷ But this premiss need not be accepted blindly. Another proponent of functional analysis clearly accepted the criticisms made by authors like Nagel and Hempel with respect to the 'strong functionalist' paradigm. In 1962, Niklas Luhmann stated that 'it is not immediately possible to explain causes by their effects' (Luhmann 1970: 10, my translation). The function of an action, seen as effect, cannot be taken to explain the factual occurrence of that action. Functional analysis thus needs some additional arguments which qualify these effects and functions. 'The functional argument is not to conclude a specific need from an existing "service" [*Leistung*] and thus to justify the existence of this service' (ibid. 15, my translation). So far, Elster and Luhmann could agree. But where Elster is sceptical that such 'microfoundations' can be found (if not on the basis of methodological individualism and causal explanation), Luhmann is sceptical that a causal model will be possible at all, assuming that an uncertainty relation obtains between cause and effect. According to him, it is not possible to determine cause and effect simultaneously, for variables in social research typically cannot be separated. For Luhmann, the interesting question is thus not: Does A always cause B? But: are

⁶ Von Foerster (1984) coined the term 'trivial machines' to denote the deterministic connection between input and output, where input is understood as sufficient condition for a certain output. One can easily see how this applies to a deterministic cause–effect relationship.

⁷ Cohen explicitly holds that functional explanations or 'consequence explanations' (as he later calls them) are a variety of causal explanations—see Cohen (1980: 130). Luhmann holds exactly the opposite position, as Berger and Offe rightly observed: 'Luhmann surprisingly, but plausibly, suggests that we reverse the relationship of "functionality" and "causality"'. In his view, functional relations are no longer a special subcase of causal relations, but causal relations a subcase of functional ones' (Berger and Offe 1982: 522).

A, C, D, E functionally equivalent to produce B? This approach opens up a space for alternative possibilities and a gain in knowledge. Luhmann consequently characterizes the 'causal sciences' as metaphysics, since they try to fix action to invariant relations between determinant causes and determined effects (cf. Luhmann 1970: 26). It seems that Luhmann's functional analysis does not claim the same explanatory power as, for example, Cohen's functionalist explanation (or any causal explanation in general); it is no accident that Luhmann avoids talking about 'explanations'. His concern is with functional equivalents which would give us more illuminating insights than strict causal connections (see also Berger and Offe 1982).

In his *Soziale Systeme*, Luhmann seems to come close to Cohen's insistence that functional analysis may be a useful tool even in the case where micro-mechanisms cannot be shown to be at work, when he writes that the increase in knowledge provided by the functional method is based on a *comparison* of causal connections which is possible even in cases where we have little knowledge of the causalities involved.⁸ The functional method is a comparative method which serves as a means for broadening the viewpoint in order to see other possibilities. It tries to find relations between relations, it relates something to an aspect of a problem in order to compare it to other solutions.⁹ Larmore (1982) and others have objected to this view in that the relation between these functional equivalents is not clear and that arbitrary equivalents could be listed. However, as Luhmann asserts, this is not the case. It is decisive that the additional points are limited by the nature and aspects of the problem one is interested in. Therefore, not everything, but few points can be added. The real virtue and achievement of this approach lies in

⁸ 'Growth in knowledge as it were cuts across causalities. It resides in their comparison. One can achieve it even if causalities are understood at first hypothetically or without being adequately researched' (Luhmann 1984a: 84, my trans.).

⁹ 'The functional method is ultimately a comparative one. And its introduction into reality serves to open up what exists there to other possibilities. Ultimately it ascertains relations among relations. It relates something to a perspective on a problem in order to be able to relate this to other solutions of the problem. Accordingly, "functional explanation" can be nothing less than the ascertainment (in general) and exclusion (in particular) of functional equivalences' (ibid. 85, my trans.).

the construction of the problem (cf. Luhmann 1984a: 86).¹⁰ However, Luhmann is not as vulnerable as Cohen, since he does not accept the underlying claim regarding scientific research. According to him, mainstream science is fascinated by a parallel between the structure of theoretical statements (*Aussagestruktur*) and the structure of the object (*Gegenstandsstruktur*).¹¹ In fact, Luhmann's decisive turn has been the adaptation of a constructivist epistemology. Cohen, on the other hand, shares the premisses of mainstream science, which makes his position in the debate with Elster more vulnerable.

One purpose of Elster's *Making Sense of Marx* was to show that whenever Marx engages in functional analysis, he goes astray, and whenever he engages in causal analysis, especially based on the premisses of methodological individualism, he arrives at good and valid results. It is beyond the scope of the present study to prove the exact opposite. However, I shall draw some attention to this point. Marx alludes several times to the model of natural sciences with which he tried to bolster his analysis in *Capital* where we find many references to chemistry, biology, astronomy, physics, and mathematics. His ultimate aim was to discover and explain the law of motion of capitalist society. He understood this law in close analogy to Newton's discovery of the movements of the planets. Once the movements and regularities are understood, we can determine the state of the universe at any point in time, in the past and in the future. We are able to predict eclipses of the sun and the moon or the

¹⁰ As Luhmann points out, functional analysis does not attempt to justify or legitimize its object of study, it is a technique of discovering problems which have already been solved in reality with the help of system theoretical assumptions (see Luhmann 1978: 6).

¹¹ For a criticism of the 'natural science model' see also Charles Taylor, according to whom this rests on 'the view that the natural sciences can provide us with paradigms for the methods and procedures of the social science. We think we understand the activity of exploring nature. Here, too, we are certainly over-complacent. But we tell ourselves a tolerably clear story of what goes on in natural science, and the very success of our research seems to indicate that we have here the norm for science in general. The prestige of this norm then stops further enquiry' (Taylor 1985: 91-2). Without embarking on an exposition of the question whether there are different sorts of scientific knowledge, we can propose two general solutions to the problem stated by Taylor: either we look for explanations *sui generis* in the social realm, or we stick to a 'monist' view, rejecting, however, the realist epistemology which underpins the natural science model. In the latter case, both natural and social sciences construct their own object of knowledge.

return of comets. Marx was convinced that he had found the equivalent for the social world. His supreme task was to show that capitalism will lead to its own supersession which is brought about by the laws of motion of capitalism itself. Only if we are aware of this line of thought are we able to understand Marx's obsession with cyclical economic crises, the law of the falling rate of profit, the general law of capitalist accumulation, etc. But today these models have less fascination. One important reason for this is that the natural sciences themselves are moving away from purely causal models. Authors like Prigogine, Haken, Eigen, von Foerster, and many others doubt the validity of causal explanation when analysing complex systems. To predict the future behaviour of such systems, the usual causal principle that the same causes lead to the same effects must be made in a stronger way. The causal principle must be that *similar* causes must lead to *similar* effects (cf. Krohn and Küppers 1989: 78) since the starting conditions of systems are never equal but always have minimal variations. As soon as we have minimal deviations of one system from the other, little causes can lead to big effects.¹² But if this is true, the strong version of causality loses its plausibility. The fascination of the traditional paradigm was based on the belief that behind all complexities one will find regularity and simplicity. This was plausible in a world in which classical mechanics served as a model for the whole of nature. The more this model is losing its paradigmatic character, the less the strong assumptions can convince. The universe is no watch, the planet is no machine, living beings are no automata (cf. *ibid.* 79).

It may be worth noting that Marx, although relying heavily on classical mechanics and especially astronomy, nevertheless lends himself to a more cautious reading. See, for example, the following passage from *Capital*:

As the heavenly bodies, once thrown into a certain definite motion, always repeat this, so is it with social production as soon as it is once thrown into this movement of alternate expansion and contraction. Effects, in their turn, become causes, and the varying accidents of the

¹² Krohn and Küppers quote the example of E. N. Lorenz who in his studies on weather found out that insignificant variations in the date set-up led to completely different developments. This was due to an exponential amplification of the small variations.

whole process, which always reproduces its own conditions, take on the form of periodicity. (*Capital* i. 593)

In the first sentence he vindicates the model of classical mechanics and tries to apply it for his social scientific analysis. In the second sentence he moves partly away from it in claiming that effects turn into causes, that there are varying accidents in the whole process which give rise to new emerging orders (*Eigenzustände*, to use a contemporary term).

It is interesting to introduce Weber's analysis of religion here. Weber used the notion of 'elective affinity' (*Wahlverwandtschaft*) to analyse specific social and cultural developments, such as the rise of Protestantism and capitalism. The term stems from chemistry and was taken up by Goethe who wrote a novel with that title.¹³ But it was also known in philosophy where Kant employed the term 'affinity'. The 'art of divorce' was his way of separating the rational from the empirical. In the final paragraph of *Kritik der praktischen Vernunft*, Kant suggested the 'moral sciences' proceed according to the methods of mechanics or chemistry:

This example [i.e. mechanics] may suggest to us to enter on the same path in treating of the moral capacities of our nature, and may give us hope of a like good result. We have at hand the instances of the moral judgement of reason. By analysing these into their elementary conceptions, and in default of mathematics adopting a process similar to that of chemistry, *the separation of the empirical from the rational elements* that may be found in them, by repeated experiments on common sense, we may exhibit both pure, and learn with certainty what each part can accomplish of itself, so as to prevent on the one hand the errors of a still crude untrained judgement, and on the other hand ... the extravagances of genius, by which, as by the adepts of the philosopher's stone, without any methodological study or knowledge of nature, visionary treasures are promised and true are thrown away. (Kant 1952b: 361, my emphasis)

Weber became familiar with Kant's philosophy via Kuno Fischer (see Howe 1978: 377). A logical or analytical affinity was a 'property of the concepts that they have certain features in common with other concepts', as the *Encyclopädische Wörterbuch der kritischen Philosophie* noted in 1797 (see Howe 1978: 376). The classical definition was that of Bergman:

¹³ Johann Wolfgang von Goethe, *Die Wahlverwandtschaften* (1809); see Howe 1978: 371.

Suppose A to be a substance for which other heterogenous substances, a, b, c, &c., have an attraction; suppose further A combined with c to saturation (this unit I shall call Ac), should, upon the addition of b, tend to unite with it to the exclusion of c, A is then said to attract b more strongly than c, or to have a stronger elective attraction for it; lastly, let the union of Ab, upon the addition of a, be broken, let b be rejected, and a chosen in its place, it will follow that a exceeds b in attractive power, and we shall have a series a, b, c in respect of efficacy. What I here call attraction, others denominate affinity. (Bergman 1970, cited in Howe 1978: 374–5)¹⁴

In the climate of the beginning of the twentieth century, with the influence of vulgar Marxists' economic determinism, Weber tried to escape such a narrow way of thinking using the metaphor of elective affinities. The vulgar Marxists' interpretation of social life and social evolution was based (1) on the base-superstructure model which was (2) taken in a causal way (3) with the superstructure explained in purely economic terms. Engels protested against this interpretation¹⁵ but his intervention hardly settled the debate. Ever since then, orthodox Marxists have had enormous difficulties in handling the relations in the base-superstructure model.¹⁶ Against this poor model, and the confusion which it caused, Weber suggested another analytical model, as, for example, in *The Protestant Ethic and the Spirit of Capitalism*:

In view of the tremendous confusion of interdependent influences between the material basis, the forms of social and political organization, and the ideas current in the time of the Reformation, we can only proceed by investigating whether and at what points certain correlations [*Wahlverwandtschaften*] between forms of religious belief and practical ethics can be worked out. (Weber 1930: 91)¹⁷

¹⁴ 'From chemistry and Bergman would come the basic paradigm of elective affinity; from literature and Goethe, its application to the portrayal of social relationships; from philosophy and Kant, the art of divorce of the empirical from the rational and the affinity of all things in their possibility' (Howe 1978: 382).

¹⁵ See his letters to Joseph Bloch, 21–22 Sept. 1890, and to Conrad Schmidt, 27 Oct. 1890, both in *MEW* xxxvii; to Franz Mehring, 14 July 1893, and to W. Borgius, 25 Jan. 1894, both in *MEW* xxxix.

¹⁶ Thousands of scholars since then have been looking for the 'last instance' or 'relative autonomy'.

¹⁷ Unfortunately, Parsons translated *Wahlverwandtschaft* as *correlation* instead of *elective affinity*. Howe's translation reads as follows: 'in view of the immense confusion of reciprocal influences between the material bases, the

Certainly, there have been attempts to define the Marxist term of 'determination' exactly in this sense of 'correspondence', or 'correlation'.¹⁸ Cohen too suggests something similar when he says that an existing productive force is only compatible *with a small range* of social relations,¹⁹ which means that a strict determination does not obtain. Weber's methodological programme is thus a comparatively modest one, in the sense that it does not establish causal or lawful connections: 'When we construct a "stage of culture", then this thought construct, analysed into judgements, means only that the individual appearances that we thereby assemble conceptually are "adequate" to one another, possess a certain measure of "inner affinity" [*innere Verwandtschaft*] . . . with one another, but never that they follow from one another with any kind of lawfulness' (Weber 1930, as cited in Howe 1978: 378).

Recall, now, Marx's analysis of capitalism and machinery. We can view it from the Cohen, Luhmann, or Weber standpoint. According to Cohen, we would get a functional relation between productive forces and social relations. According to Luhmann, there may be functional equivalents to actual solutions and we should avoid the mistake of regarding the actual as the 'necessary' and inescapable solution. Piore and Sable, for example, claim that handicraft production (combined with computer technology) may well be a 'functional'²⁰ alternative to industrial mass production (Piore and Sable 1984). According to Weber, there must obtain 'elective affinities' between the elements which form a unit. The question of whether machinery is compatible with communist society may serve as an example here. As we

forms of social and political organization, and the intellectual and spiritual contents of the cultural epochs of the Reformation, one can proceed only by first of all inquiring as to whether and in what points definite elective affinities between certain forms of its religious faith and its work ethic are discernible' (Howe 1978: 368). See also Schluchter 1981: 142.

¹⁸ See Raymond Williams's suggestion that a determination sets only limits and does not determine (*bestimmen*) in the strong sense (Williams 1977: 83–9). But the problem is not just a semantic one of how to translate the German 'bestimmen', since Engels already had trouble explaining what 'bestimmend in letzter Instanz' meant (see above).

¹⁹ The underdetermination of the relations by the forces of production is developed in Cohen 1978: 163–5.

²⁰ I put 'functional' in quotation marks because the authors themselves do not use the term.

have seen in Chapter 3, Marx was ambiguous about this problem. In the *Manuscripts 1861–3*, he regarded machinery as inherently deskilling, leading to the enslaving and crippling of human beings. In *Capital*, he revised this position, stressing the co-operative character of mass production and blaming only the social form, that is, capitalism which employs machinery. From the viewpoint of present-day Western societies we might add the effects of machinery on the natural environment. In the following sections I shall thus try to establish some possible relations between capitalism and machinery, postponing the question of communism to Chapter 5.

4.2 Capitalism and machinery as autopoietic systems?²¹

The starting-point for my elaboration here is the curious way in which Marx links capitalism and machinery. He wants to stress that capital has found in machinery its adequate mode of production (*MEGA* II. iii. 6. 2142–4), which is to say that before the use of machinery the mode of production could not be called capitalist:

Modern Industry had therefore itself to take in hand the machine, its characteristic instrument of production, and to construct machines by machines. It was not till it did this, that it built up for itself a fitting technical foundation, and stood on its own feet. (*Capital* i. 363)²²

With respect to the social form, he says that only from that point on, where capital exists in its 'pure' form (i.e. essentially as capital–labour relation), does it stand on its own feet and is therefore capitalist in the real sense of the word.

The capitalist system presupposes the complete separation of the labourers from all property in the means by which they can realize their labour. As soon as capitalist production is once on its own feet, it not only maintains this separation, but reproduces it on a continually extending scale. (*Capital* i. 668, amended translation)

This is a process which 'transforms, on the one hand, the social means of subsistence and of production into capital, on the

²¹ This section owes much to discussions I had with Gunther Teubner.

²² *Grundrisse* 699; cf. also *MEGA* II. iii. 6. 2059. It would be interesting to ask if this is also true the other way round. In other words, can we assume that machinery has found in capital its adequate social expression?

other, the immediate producers into wage-labourers' (*Capital* i. 668). The capitalist mode of production 'produces not merely the material products, but reproduces continually the production relations in which the former are produced, and thereby also the corresponding distribution relations' (*Capital* iii. 879).

In both cases the 'crutches' of pre-capitalist modes of production could be thrown away. We are thus in both cases dealing with self-referential operations: production of capital by means of capital, production of machinery by means of machinery. It seems tempting to apply autopoietic systems theory to these two processes since Marx himself conceives the material and the social as self-referential processes.²³

Autopoietic theory has been developed in biology (Maturana 1982; Varela 1979, 1981; Maturana and Varela 1980) and in social theory (for example, Luhmann 1984a; Hejl 1982; Willke 1983, 1986, 1987; Teubner 1988a, 1988b, 1988c, 1989a, 1989b).²⁴ This 'emerging paradigm'²⁵ takes as its point of departure the concepts of 'self-reference', basic circularity, and operative closure of social systems. However, as has been emphasized by several authors (Teubner 1987, 1989a; Roth 1987; Bühl 1987; Zolo 1991), one has to be careful not to mix up the concepts of self-referentiality, self-reproduction, and autopoiesis.

Autopoietic theory defines system and environment in a different way from 'General Systems Theory'; it combines systems theoretical elements with evolutionary theory and constructivist epistemology. In some versions, like Luhmann's, it tries to overcome basic theoretical difficulties of older sociological approaches, like Parsons's structural functionalism or General Systems Theory.

How is an autopoietic system defined? Stichweh, following

²³ Sztompka (1974: 177) has claimed that 'Marx may be pronounced the forefather of the modern systems approach in social sciences'. In an illuminating article, Amburgery and McQuarie try to interpret Marx's categories in a systems theoretic way. In contrast to Cohen, who stresses the primacy of the productive forces, Amburgery and McQuarie emphasize the 'reciprocal linkages between the various subsystems of this model' (Amburgery and McQuarie 1977: 100).

²⁴ For a critique which is not completely hostile to the concept of autopoiesis as such, but doubts the validity of using it in broad analogy to biology as a new 'super-paradigm', see Bühl 1987.

²⁵ Some authors call it a 'revolutionary paradigm', cf. Krohn, Küppers, and Paslack 1987.

Luhmann, gives four criteria which must be fulfilled to call a social system autopoietic:

1. operational closure: operations of the system relate only to operations of the same system;
2. definition of its own elements: the systemic process defines what will function as its elements;
3. production of its own elements: an autopoietic system is a network of processes which produce elements for this system;
4. self-definition of the system-boundary (see Stichweh 1987: 448–9).

Someone might propose to apply criteria (1)–(3) to technology and say that technology is operationally closed and has clearly defined elements. He would probably describe technology as a system of instrumental artefacts which produces instrumental artefacts.²⁶ Taking this assumption for granted for the sake of the argument, we could therefore say that technology is operationally closed. Turning to the elements of the system, we might say that it does not matter which substances the elements of an autopoietic system consist of (they may be books, factory buildings, banks, or persons), because 'elements' of the system are not things or persons, but operations. However, as will become clear in a moment, such a proposition fails for two reasons: (1) technology cannot be conceived as a social subsystem of society; (2) the material aspect of technology has not to be neglected: technology is *not only* a 'meaning-based system'. According to Luhmann, a social system 'consists of meaningful communications—only of communications, and of all communications. It forms its elementary units from the synthesis of information, communication, comprehension . . .' (Luhmann 1988a: 18). To be sure, technology could be conceived as a specialized social communication which can be defined apart from political, religious, economic, and scientific com-

²⁶ It would be production of technology by means of technology (to allude to Sraffa's *Production of Commodities by Means of Commodities*). Taken in the above sense, technology would be a special case of commodity. A commodity is the unity of exchange-value and use-value. There seems to be no problem in regarding value production as a self-referential process. But what about use-values and, specifically, technology? Marx himself gave us a few hints to conceive technology in terms of basic circularity; see e.g. *Capital* i. 363; *Grundrisse* 699. As I shall argue, this line of argument cannot be maintained.

munications. Technology could even be conceived of as a self-referential and self-reproductive process: whenever engineers are constructing a new technology, they are likely to take machines and textbooks of colleagues as models (see Rammert 1988). However, technology cannot be conceived as exclusively based on meaning, as other social systems can. It would be absurd to see the essential elements in a thus conceived technological social system as consisting of communicative events. What gives technology its specific role in social life is, on the contrary, that some of its basic elements are material in character.

In addition to the above definition of a social system, Luhmann calls a social system an autopoietic system in so far as it is

a recursively closed system, which can neither derive its operations from its environment nor pass them on to that environment. It cannot communicate with the environment but it can and must necessarily communicate *about* the environment . . . This is a very clear, very unequivocal state of affairs, which does not pose any fundamental difficulties in the concept of unity or in the demarcation of the system from the environment . . . [The system] does not, for example, consist of physical events nor of isolated individual behaviour. (Luhmann 1988a: 18–19, emphasis added)

According to Luhmann's position, 'An autopoietic system . . . constitutes the elements of which it consists through the elements of which it consists' (ibid. 14). Elements of a social system are events or communications. Events 'have no duration in which they can change, but disappear immediately on their emergence . . . Since the social system . . . consists of nothing but communications, it belongs to this type of system that consists of events' (Luhmann 1988b: 341–2). From this account it is difficult, if not impossible, to conceive technology as a social system—it would only be possible if technology is defined in a broad way (see ch. 3).²⁷ Take first the aspect of

²⁷ From Luhmann's quote it also becomes clear that Marx's thought and autopoietic theory are located on two different 'ontological' levels: the former assumes that societies are able to have direct contact with their environment, the latter denies exactly this and insists on the purely communicative dimension of society. For Marx, the possibility that society has a direct contact with nature was at the very heart of his theory. As we saw, he regarded the conscious transformation of nature as the precondition for history. For autopoietic theory, on the other hand, an environment 'out there' does not exist; what exists is only system-internal constructions of reality. I return to this problem below.

events. Since technology produces durable artefacts, it hardly falls under the category of an 'event'. Consider, next, the aspect of communication. Technology may be conceived of in communicative terms as well. This is the case when, for example, engineers discuss the design of a new machine, or when politicians confer on the problem of dangerous technologies. But the 'essence' of technology can hardly be grasped with the notion of communication alone. Technology typically produces 'a machine, a drug, or a process of some kind' (Price 1982: 170).

Luhmann additionally brings to bear a further criterion: every functional subsystem of society has its own 'binary code' which organizes its operations. For example, he defines money as the code of the economy, power as the code of the political system, truth as the code of the scientific system, etc. The point of Luhmann's argument is that the autonomy of the various social systems consists in their coding: it is the economy which decides what counts as payment and what does not; it is the political system which decides what counts as power and what does not; it is the scientific discipline which decides what counts as scientific knowledge (truth) and what does not. It follows as a corollary that politics cannot solve problems of science, the economy cannot solve problems of the political system, science cannot solve problems of the economy, etc.

In this sense a technological system is neither a social nor an autopoietic system. It is the realm in which mankind organizes its *Stoffwechsel* with nature.²⁸ This is a process which proceeds partly by means of communication, partly by means of material transformation of the environment. From my definition and the discussion in section 3.3 it follows that the material dimension is crucial for the concept of technology. Luhmann's theory also draws attention to this material element as the 'eternal presupposition' for social systems:

All systems form in a presupposed materiality continuum, which Maturana calls medium. For example, they presuppose a structure of matter rooted in atoms, just as the formation of atoms obviously

²⁸ Technology should thus be defined as 'allopoietic' because of its heterogeneous character (cf. Maturana 1982: 159). It is essentially instrumental, a pool of skills and knowledge which is linked to all other systems: science, economy, and politics.

presupposes energy capable of being bound. In the formation of systems, then, there is never any kind of recreation of the world in each individual case. This materiality continuum which has in each case to be presupposed takes no heed of the system boundaries of the differentiating system; it is both inside and outside the system. It nevertheless limits the possibilities of system formation, since only such systems are possible that are compatible with the materiality continuum. The emergence of social systems based on meaning processing presupposes the existence of a multiplicity of such materiality continua and is thus rather improbable. (Luhmann 1988b: 338)

Social systems rest on this material continuum but operate on the basis of social meaning. In so doing, they are constructing their own social reality. So far the use of the notion of material continuum is in accordance with Luhmann's use. However, I think we can make use of it in another respect as well. It fulfils the function of keeping together the different social systems 'from below'. It makes plausible the claim that politics, economy, and science not only are occasionally or punctually in contact but are coupled on the basis of this material continuum. This provides the 'material basis' for the linkage of the social systems. The potential financial reward of a technological invention links technology immediately to the economic system, perhaps without giving much importance to science. Science is part of the environment of the economy, that is, inventions depart from an available given standard of scientific knowledge. If for political reasons research is directed towards certain goals, it is the political system which gives rise to that research. The financing involves the economic system too. The political system may also enhance technological development in a direct way by subsidizing innovative firms.

At this point a basic objection could be made. As I discussed Marx's model of *Stoffwechsel*, it was clear that society (by virtue of its *Arbeitsprozeß*) had the possibility of transforming the environment in a physical way. It is precisely this possibility that is denied by Luhmann. It is impossible for society to derive operations from its environment and to pass operations on to that environment. How can we, then, reconcile the proposed systems approach with Marx's analysis of technology? Are the two theories mutually exclusive since they presuppose different ontologies?

I shall not doubt that the theories are ontologically disparate. However, they are by no means incompatible. The solution draws on the notion of 'materiality continuum' which is presupposed by systemic operations and which is inside and outside social systems.

In Marx, the labour process is a goal-orientated transformation of nature which takes place with tools (or processes) and is *zweckrational*, i.e. determined by means-ends relationships. From this goal-orientation it follows that technology stands in a close relationship to rational human action or to a systemic rationality: the goals are in most cases clearly defined by technical imperatives: produce product x!, solve problem y!, adjust z! whereas autopoietic systems do not have a final goal, end, or 'telos'. The product and goal of their working are they themselves. When Marx analysed the valorization process (capitalist economy), he employed a method which imagines traits of 'basic circularity' and self-reference, even of autopoiesis.²⁹ The capitalist economy is an autopoietic system *par excellence* (see also Breuer 1987). But, as we have seen, it is not possible to extend this analogy to the process of use-value production as such, to man's transformation of nature, in short, to technology.

These considerations suggest that the possibilities of influencing technology are not so small. It seems that pessimistic analyses which have it that technology has slipped out of control of human action (Ellul 1964; see also Winner 1977) tell only half the truth: it is true, indeed, that technology is evolving according to its own *Sachgesetzlichkeit* ('technical imperatives'), moves in the way of 'trajectories', and cannot be determined by individual action. Furthermore, it is true that attempts to change existing technologies in some desired direction must fit three different logics or 'systemic codes'. This narrows down the range of feasible possibilities. But it is not true that technology as such develops according to its own logic (inner code), or even moves away from the human world. A pessimistic argument would have to show that all technologies have merged together into one autonomous technological trajectory which cannot be changed.³⁰ But theoretical considerations and empirical evidence

²⁹ See his definition of capital as essentially referring to itself, as 'automatisches Subjekt' (*Das Kapital* I, 169).

³⁰ See Adorno and Horkheimer 1981 as an illustration of such pessimism.

can show that the social impact on technological development is considerable. Before explaining this, I shall briefly address the self-referentiality of technology.

In a particularly useful essay, Hughes addresses the problem of identifying a technological system when he says that '[t]echnological systems solve problems or fulfil goals using whatever means are available and appropriate; the problems have to do mostly with re-ordering the physical world in ways considered useful or desirable' (Hughes 1987: 53). However, his approach is not informed by autopoietic theory. Rather, so it seems, he remains with a model which conceives systems as open, input-using, and output-producing. But then how do we distinguish a technological system from any other system? Or are all social systems varieties of one, all-embracing technological system? In this case we could conceive of the technological system as a subsystem of every social system: politics, law, economy, and art use technologies.³¹ Hughes is also aware of the difficulty when endorsing the wide definition of technology. He thus tries to make the following qualification to the definition of technology: 'It is problem solving usually concerned with the re-ordering of the material world to make it *more productive* of goods and services' (ibid., my emphasis). However, the criterion of productivity is basically an economic one, that is, technology itself cannot measure its own 'productivity'. Engineers who work in the field of machines and power transformation usually use *Leistungsgrad* (performance) as an indicator for the efficiency of their products, but this physical criterion is quite different from efficiency in the economic or social sense. This leads to the paradoxical situation in which a distinction is applied to itself, for example, Is it legal that law distinguishes between the legal and illegal? (See, for example, Fletcher 1985; Luhmann 1988c.) In our case we could ask: is a new productive device productive or not? This is to say that technology stands in a relation of augmentation to itself. What counts as more productive is open to debate. A higher energy-balance need not be more efficient in the economic sense.³² This historical record of capitalism so far

³¹ See Weber 1978: 32; Ellul 1964.

³² It may be noted that Hughes's solution resorts to actor models where an actor measures and defines progress. It sounds ironic, but to make his system approach work, he needs a systems builder, i.e. a person who forges the

shows that economic criteria played a crucial role in this evaluation. The successful entrepreneur has most importantly to unite economic and engineering skills and knowledge.³³ But today other factors are entering this evaluation. For example, effects on the natural environment which are recorded by scientific research, monitored by politics, and transformed into decisions which are based on some social acceptability of technologies ('technology assessment' and 'Sozial- und Umweltverträglichkeit').

Having rejected the notions of an 'autonomous' technology and of technological system, I now ask: How shall we conceive of the coevolution of technology and society? Is technology at any point in time socially determined and hence subjected to human design? Instead of determining life, is it not itself completely determined by social arrangements? I deal with this question in two steps.

1. As far as the question juxtaposes social and technological determinism, it is paralleled by a similar ambivalence in Marx. As I suggested above (see s. 3.4), Marx believed in both technological determinism and social determinism because of a twofold theoretical interest. Its first element is historical: to find out which variable 'explains most'; the second element is critical: to estimate the technological and social possibilities and requirements for a communist society. From this follows Marx's reductionism and his determinism of one sort or another. There is nothing wrong with reductionism and determinism if it is supported by certain theoretical assumptions and empirical evidence. My suspicion is, however, that Marx was led astray by this approach. He wavered between a social and a technological determinism depending on his prevailing theoretical interest. In a very rough way,³⁴ we can say that he was a technological determinist when he tried to explain historical development ('backwards'-orientated), but became a social determinist when

heterogeneous elements together and takes care that new technology will be more productive.

³³ As Schumpeter put it, '[i]t is therefore quite wrong . . . to say, as so many economists do, that capitalist enterprise was one, and technological progress a second, distinct factor in the observed development of output; they were essentially one and the same thing' (Schumpeter 1987: 110, see also 132).

³⁴ For the necessary qualifications, see s. 3.4.

he tried to evaluate the possibilities for a communist society ('forwards'-orientated).³⁵

Recent studies in the history and sociology of technology are strongly opposed to technological determinism (Pinch and Bijker 1987; Hughes 1987; Law 1987; MacKenzie 1987) and argue for a strong social determinism. Pinch and Bijker try to apply the 'strong programme' (developed in the sociology of science) to technology. The label they adopt therefore is 'Social construction of technology' (SCOT). The starting-point for their approach is the Kuhnian notion of scientific paradigm, especially as further developed by Mulkay and others. Whereas Kuhn restricted his analysis to the natural sciences, several attempts have been made to extend it to the social sciences. Pinch and Bijker now try to apply it to technology, thus claiming that technology, just like natural and social sciences, is a social construction which gets stabilized during a process of 'closure', that is, technologists come to agree on a specific technology as the solution to a specific problem. There is nothing 'inherently' superior in a technology which becomes dominant over competing technologies; it is simply a matter of convention. From this it follows that a history of technology has to dispense with the idea that dominant technologies are 'better' technologies in comparison to others. The point is to treat successful and unsuccessful technologies in the same way ('symmetry of explanation') and to show how contingent factors led to a decision which selected this or that technology. In my view this approach is a good starting-point for any sociological analysis of technology. However, there are two comments I should like to make. The first is that the notion of 'social shaping' is too vague. As I have shown above, the 'social' must be further decomposed into social subsystems (politics, economics, and science) in order to trace the inner dynamics of technology. From this it follows that it is not sufficient that 'technological closure' takes place; the technology which is successful in the 'middle run' has to be compatible with economic and political factors as well. The second point is that Pinch and Bijker try to employ their argument as an argument against an evolutionary view of technology. They assume that once they can show that a process of closure

³⁵ As we saw in ss. 3.5 and 3.6, the two approaches can be found in a nearly ideal-typical way in the *Manuscripts 1861-3* and in *Capital*.

takes place in the technological field, this is evidence against an evolutionary view of technology. But this assumption is completely mistaken; the contrary follows from their argument. To disprove an evolutionary view it is not sufficient to show that intentional human actions and choices are at work. As the example of the deck of cards (cf. Weick 1979) can show, an attribution of the label 'evolution' to any development of an entity over time depends in the first place on the criteria of order which an observer wants to apply (see also s. 3.1.2).

Thomas P. Hughes admits that technological systems 'are both socially constructed and society shaping' (Hughes 1987: 51). Viewing technology as system, he comes close to attributing an autonomous development to it. However, Hughes refuses to subscribe to such a notion. He coins the term 'momentum' for the phenomena that technological systems consolidate and grow. As he explicitly points out, '[m]omentum . . . remains a more useful concept than autonomy. Momentum does not contradict the doctrine of social construction of technology, and it does not support the erroneous belief in technological determinism. The metaphor encompasses both structural facts and contingent events' (ibid. 80). I think this formulation makes the point very well: what is needed is a theory which is capable of combining structural and contingent events. Hughes, however, does not offer much of such a theory. Unfortunately, he limits himself to historical illustration and very weak theoretical generalizations. On the one hand, he doubts the autonomy of technology (ibid. 79), on the other he concedes that '[l]arge systems with high momentum tend to exert a *soft determinism* on other systems, groups, and individuals in society' (ibid. 54–5, my emphasis). But how can technology exert a determining force if it is not autonomous? This question leads to the second step of my discussion.

2. As far as the question juxtaposes autonomous and heterogeneous systems the following can be said. It seems that it is not possible to impress a specific shape on existing technology at any time in any direction. Such attempts are likely to fail in one of three senses: these attempts may be dysfunctional, irrelevant, or detrimental to the acting system itself.³⁶ As Piore and Sabel

³⁶ Cf. Teubner's 'regulatory trilemma'; Teubner 1985.

(1984) maintain, there exist specific 'branching points' in the development of technology which make 'human choice' possible. But apart from the strong notion of social construction of technology, we should consider another possibility which goes beyond the question of 'determination'. In this view technology is conceived of as having some 'eigendynamics' (in the sense that technical properties inhibit or enhance certain technological developments), but is at the same time shaped by social factors. Let me thus return again, this time in more detail, to evolutionary theory.

4.3. Evolution and Darwinian systems

Since Marx's analysis explicitly attempts an evolutionary explanation of productive forces and mode of production, we might look a little more closely at Darwinian systems. Eigen and Schuster (1977, 1978a, 1978b) have emphasized the following properties of Darwinian systems which they regard as their 'necessary prerequisites':

The essential requirement for a system to be self-selective is that it has to stabilize certain structures at the expense of others . . . The criteria for evaluation must involve some feedback property, which ensures the identity of value and dynamic stability. An advantageous mutant, once produced as a consequence of some fluctuation, must be able to amplify itself in the presence of a large excess of less advantageous competitors. (Eigen and Schuster 1977: 547)

The 'advantageous mutant' in our case is, of course, the machine. But Marx's theory also contains an evolutionary scheme for the modes of production. The 'advantageous mutant' in this case is capitalist commodity production. Generally speaking, the new emerges as a result of recombinations of the already existing, as Loh emphasized: during development and change the new does not simply supplement the already existing but is constituted from the pre-existing by means of development of the form (Loh 1975: 261). Purely incremental change need not lead to evolutionary change of forms. According to Schumpeter's striking phrase, you may 'add as many mail-coaches as you please, you will never get a railway thereby' (Schumpeter 1934: 54).

We can conceive the evolution of technology (machinery) and

mode of production (commodity production) in isolation from each other and in coevolution with each other. The first would apply to machines which emerged long before capitalism. It is the case of specialization and differentiation that Marx refers to. They were the precondition for the rise of machinery. The two model machines which the sixteenth century inherited from antiquity were the clock and the mill (cf. Marx's letter to Engels of 28 Jan. 1863. Note that neither machine is based on a deskilling of the handicraft worker.) Capital also existed before capitalism, above all in the form of money-capital. The interesting question, then, is how the two came into touch with each other, triggering off hitherto unknown technological dynamism.

One of Marx's implicit theoretical tasks was to provide an explanation for the fact that out of a variety of technologies and modes of production the capitalist mode and machinery, combined together, became the successful ones and drove out all others (or pushed them into 'niches').³⁷ The mechanism of the self-organizing hypercycle is described by Eigen and Schuster in the following way:

Functional integration of an ensemble consisting of several self-replicative units requires the introduction of catalytic links among all partners. These linkages, superimposed on the individual replication cycles of the subunits, must form a closed loop, in order to stabilize the ensemble via mutual control of all population variables. Independent competitors, which under certain spatial conditions and for limited time spans may coexist in 'niches', as well as catalytic chains or branched networks are devoid of self-organizing properties, typical of hypercycles. Mere coexistence is not sufficient to yield coherent growth and evolution of all partners of an ensemble. (Eigen and Schuster 1978a: 40-1)

Recall here Marx's description of capitalism where machines are built by machines, capital produced by capital, and, as a precondition, labourers are separated from all means of produc-

³⁷ Ballmer and von Weizsäcker criticized Eigen and Schuster's model of the hypercycle for not allowing for 'niches': 'Eigen leaves *isolation* out of the picture. However, this is a factor of equal importance with mutation and selection' (Ballmer and von Weizsäcker 1974: 248, my trans.). This neglect might inhibit the very emergence of evolution: 'Eigen's theory builds up its own decisive barrier against an evolution beyond the stage of hypercycles: the strategy of extirpation of the successful hypercycle against all others which is laid out in Eigen's quasi-physical criterion of fitness' (ibid.).

tion. Before the advent of capitalism, all these elements (also the model machine *mill*) had existed in niches. As we shall see, Marx is never sufficiently clear on whether technology is a 'self-replicative unit' or a 'functional linkage'.³⁸

Eigen and Schuster list several properties of the so-called hypercycle, of which the seventh is of special interest here: 'Selection of a hypercycle is a "once-for-ever" decision. In any common Darwinian system mutants offering a selective advantage can easily grow up and become established. Their growth properties are independent of the population size. . . a hypercycle, once established, can not easily be replaced by any newcomer, since new species always emerge as one copy (or a few)' (Eigen and Schuster 1978a: 41). With these methodological tools, we may read the following passages from the *Manuscripts 1861-3* and gain new insight into the problems with which Marx was confronted in his enterprise.

In the following passage, Marx stresses the gradual development of modes of production and technology using an analogy to geology:

As, with the sequence of different geological formations, one should not believe in sudden and sharply distinguished periods, the same is true of the making of the different economic formations of society. In the womb of artisan production the beginnings of manufacture developed and here we already find a partial usage of machinery. (MEGA II. iii. 6. 1972)

Note that Marx, while speaking of 'economic modes of production', gives examples of technologies in order to distinguish them: artisan production, manufacture, and machines. Evolutionary theory also stresses the gradual development, the emerging of one form out of another: 'Evolution is conservative and therefore appears to be an almost continuous process, apart from occasional drastic changes. Selection is in fact based on instabilities brought about by the appearance of advantageous mutants that cause formerly stable distribution to break down. The descendants, however, are usually so closely related to their immediate ancestors that changes emerge very gradually' (Eigen und Schuster 1978b: 367). I think it is revealing to confront this

³⁸ See von Neumann 1966 for an exposition of how we may conceive of machines capable of self-replication.

statement with the following three passages from Marx: 'The general law, however, which is constant, is that the material possibility of the later form is produced in the former, as regards both the technological conditions, and the corresponding economic structure of the atelier' (MEGA II. iii. 6. 1973).

Compare also the following illuminating passage from the *Grundrisse*: 'It must be kept in mind that the new forces of production and relations of production do not develop out of nothing, nor drop from the sky, nor from the womb of the self-positing Idea; but from within and in antithesis to the existing development of production and the inherited, traditional relations of property' (*Grundrisse* 278).

And in the *Manuscripts 1861-3*:

Here we have to remark above all that we are not dealing with a precise technological divide but with a revolution in the employed means of production which transforms the mode of production and therefore the relations of production. (MEGA II. iii. 6. 1915)

Once the revolution of the productive forces has been achieved (which reveals itself technologically), a revolution in the relations of production also occurs. (MEGA II. iii. 6. 1973)

It may be said that these quotes strongly support a technological-determinist view of history, that is, the emergence of the machine caused the change in the relations of production: after the revolution in productive forces comes a revolution in the relations of production. But there need not be a *causal* relation. Marx only says that with technological revolution a social revolution also occurs. Technical and social revolution could thus be parallel processes, without causal links. This interpretation is further supported by Marx's affirmation that not only present technology but also the present mode of production must have forerunners in the previous evolutionary stage when he says that 'the later form is produced in the former, as regards both the technological conditions, and the corresponding economic structure' (cf. above, quote from MEGA II. iii. 6. 1973).

This allows two possibilities of conceiving the 'social' and the 'technical': a causal and a functional model of historical change. We may interpret the following passage in both ways:

The differentiation, specialization, and simplification of tools in manufacture which is based on the division of labour—their exclusive

adaptation to very simple operations—is one of the technological, material preconditions for the development of *machinery as an element which revolutionizes the mode and relations of production*. (MEGA II. iii. 6. 1914, my emphasis)

Consider first the causal interpretation. According to this the division of labour leads to ('causes') differentiation and specialization of the work instruments, which constitutes the material condition for the development of machinery. Machinery, in turn, is one of the elements which leads to a revolution of the mode and the relations of production. If we leave aside the division of labour for a moment, we get the sequence shown in Fig. 4.1.

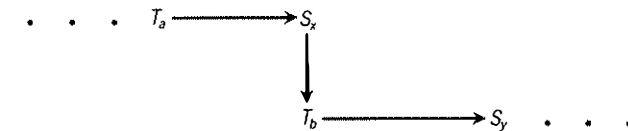


FIG. 4.1

Technology T_a leads to social revolution and eventually to social form S_x . Within this social form S_x a new technology T_b arises which brings about social form S_y . Note that we have both a technological and a social determinism here: $T_a \rightarrow S_x$ stands for the technological, $S_x \rightarrow T_b$ stands for the social determinism. There is a causal effect of technology on the social form before a revolution and a causal effect of the social form on technology after a revolution. The canonical source for a technological determinism is the 1859 *Preface*; support for social determinism is found in the following passages from *Capital* i:

At a given stage in its development, the narrow technical basis on which manufacture rested, came into conflict with requirements of production that were created by manufacture itself. (*Capital* i. 347)

Manufacture produced the machinery, by means of which Modern Industry abolished handicraft and manufacturing systems in those spheres of production that it first seized upon. The factory system was therefore raised, in the natural course of things, on an inadequate foundation. When the system attained to a certain degree of development, it had to root up this ready-made foundation, which in the

meantime had been elaborated on the old lines, and to build up for itself a basis that should correspond to its methods of production. (*Capital* i. 361)

In both cases the 'requirements' or the 'methods of production' are the driving force which cause a change in technology. This is a clear illustration that the growth of the productive forces has to be explained in a social way. Consider now the second possibility (see Fig. 4.2):

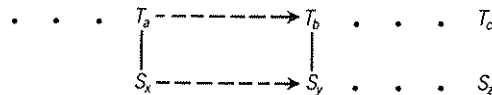


FIG. 4.2

In the language of Eigen and Schuster this is a case of 'functional integration'. Such a functional integration requires 'catalytic links' between the self-replicative units. These linkages must form a closed loop in order to stabilize the ensemble (see Eigen and Schuster 1978a: 40–1). Similarly, Marx wants to establish a kind of 'elective affinity' between machinery and capitalism. This elective affinity has the following traits. Capital as 'processing value' does not know any limits. Likewise, machinery does not depend on craft skills of workers nor on an increased working population in order to produce more commodities: the sole limits are physical (raw materials) and technical in character. As a result, a worker who is employed by capitalist machinery becomes dispossessed in two ways: in the technological realm, he gets dispossessed of his skill, in the economic realm, of the product of his labour.³⁹ Note that in the case of a functional integration we have a coevolution of social forms and technologies. When Cohen says that 'slavery rules out computer technology, but also computer technology rules out slavery' (Cohen 1978: 153), I shall leave open for the moment the question whether capitalism with, say, craft technology as dominant technology is equally impossible (see ch. 5).

³⁹ I leave aside here whether this expropriation is 'just' or 'unjust'—see the contributions in Cohen *et al.* 1980 and Geras 1986 for a good discussion and a complete overview of the literature.

4.3.1. A machino-capitalist hypercycle

Using the definition of Eigen and Schuster as heuristic device, I shall now try to define the 'self-replicative units', the 'catalytic links', and the 'closed loop'. In a first tentative approach, the 'self-replicative units' might be listed as follows:

1. capital;
2. labour power;
3. machines;
4. raw materials.

In Marx's view, as laid out in the 1859 *Preface* and elsewhere, productive forces, relations of production, and the superstructure stabilize each other. Elements (1)–(4) from the above list all existed before capitalism; the 'capitalist hypercycle', however, is structured by the recomposition of all elements.⁴⁰ (1)–(4) are commodities which can be bought on the market; they fuse together in the production process where (1)–(2) constitute a social relation, (2)–(3) a technical relation, (2)–(4) the elements of (1) (value) under the aspect of use-value.⁴¹ But if Marx links up machinery and capitalism in such a definite way, it is impossible to speak of 'Maschinerie an sich', independent of (bad) capitalist use: machinery is capitalistic, capitalism is machinery. Consequently, the historical perspective must change: a post-capitalist society must also be a post-machinery society. From the *Poverty of Philosophy* onwards, where he says 'The handmill gives you the feudal lord',⁴² Marx has a curious theoretical scheme in

⁴⁰ In the *Grundrisse* Marx emphasizes that the separation of these elements was the outcome of a long historical process of dissolution of old forms of production. 'It is not the case that capital creates the objective conditions of labour' (*Grundrisse*, Berlin edn.: 406; my trans.). Capital is the product of an evolutionary process, as are the instruments of work. 'The merit of capital consists only in uniting hands and instruments (which it has already found) under its control' (*ibid.* 407; my trans.).

⁴¹ Marx additionally emphasizes that (1) and (3) dominate (2); since 'domination' has no place in Darwinian systems, I shall leave this aside here.

⁴² 'Social relations are closely bound up with productive forces. In acquiring new productive forces men change their mode of production; and in changing their mode of production, in changing their way of earning their living, they change all their social relations. The handmill gives you society with the feudal lord; the steam-mill, society with the industrial capitalist' (CW vi. 166). The example of the handmill may be historically untenable (see Elster 1985), but here I want to emphasize that it was Marx's aim to find such correspondences.

mind. It consists of the law-like connection of (1) forces of production, (2) mode of production, and (3) relations of production. The most significant and famous expression of this is to be found in the 1859 *Preface* and is commonly called 'historical materialism'. My claim is that Marx attributes to each of these analytical units an elementary form,⁴³ as the following scheme shows. I consider all cases in turn. In the case of (1) productive forces it is artisan-, manufacture-, and machine-production. In the case of (2) mode of production it is use-value and commodity production ('The commodity is the elementary form of bourgeois wealth'). The crucial point around which Political Economy revolved, and which only Marx solved (so he claimed), was his discovery that in capitalism the product (i.e. the commodity) reflects the double character of labour which is embodied in it. In other words: the commodity unites use-value and exchange-value just as labour unites use-value-orientated concrete labour and exchange-value-orientated, surplus-producing abstract labour. Marx explicitly credited himself with this discovery (see his letter to Engels of 8 Jan. 1868).

In his evolutionary model we get the sequence (i) use-value, (ii) exchange-value (commodity), and again (iii) use-value production. As in ancient Greece, the Middle Ages (i.e. its artisans) were producing essentially use-value, not primarily exchange-value. This is the crucial point for Marx. But he cannot simply return to the Middle Ages or to antiquity since he wants to establish a use-value-orientated production *on the basis of capitalist productivity* (but without domination of exchange-value). The high level of productivity is the valuable point in the case of capitalism. Marx's vision of communism seems to

⁴³ Maybe we are now living in a post-machinery age which is characterized by electronic and cybernetic systems. Accordingly, we should expect a social form which corresponds to it. Much has been said about 'post-industrial' society and its characteristics. In my view, however, the central difference in contemporary modern societies is not their industrial or post-industrial character but the difference between stratified class societies and functionally differentiated societies. In Marx's model a class division occurs also on the technological level since the great majority of the working class is an 'appendage' to the machine. If we apply his model to present Western societies, we would expect a new technology which is different in this respect. If machines were run by workers who are not reduced to appendages, we could speak of a new, liberating technology. See Kern and Schumann 1986 for some empirical examples.

assume that all good things go together—cf. Elster 1985 and Lukes 1985.

On the level of (3) relations of production, we have slavery, feudalism, capitalism, and communism. (i) corresponds to antiquity, (ii) to capitalism, and (iii) to communism. Note that there corresponds an ethical evolutionary scheme (*Grundrisse* 158 and *German Ideology* [CW v. 78–9]), where Marx says that individuals were freer before the advent of capitalism. Habermas seems to be more optimistic as regards the evolutionary potential of the 'ethical realm' when he says:

Whereas Marx localized the learning process important for evolution in the dimension of objective thought—of technical and organizational knowledge, of instrumental and strategic action, in short, of *productive forces*—there are good reasons meanwhile for assuming that learning processes also take place in the dimension of moral insight, practical knowledge . . . learning processes that are deposited in more mature forms of social integration, in new *productive relations*, and that in turn first make possible the introduction of new productive forces. (Habermas 1979: 97–9)

The Middle Ages already partly produced commodities. Antiquity and communism have a social character of production. The first is regulated by blind rules, the second by a conscious plan (and the application of science). In feudalism and, above all, in capitalism, the market co-ordinates the many independent private producers.⁴⁴ If we represent these three evolutionary strands graphically, we can detect an empty field (see Fig 4.3).⁴⁵

A return to use-value production in communist society takes place on a higher and broader level than the ancient one—on a higher level because mankind has more developed needs, and more capacities to fulfil them, on a broader level because the development of productive forces is enjoyed not only by a polis but by the whole of mankind.⁴⁶

⁴⁴ It has been claimed that there exist basically two forms of socialization: markets and hierarchies (see Williamson 1975). Another position holds that there are three forms: market, organization, and solidarity (see Polanyi 1944). As we shall see, it can be claimed that communism would, or should, be marketal, hierarchical, or solidaric—or a mixture of them.

⁴⁵ Lenin, in popularizing terms, defined communism as 'Soviet power plus the electrification of the whole country' (see Lenin 1920: 515 and Ziegler 1987: 24).

⁴⁶ I have remained strictly within the framework provided by Marx and therefore do not discuss the (questionable) heuristic value of an approach which

Mode of production	Antiquity	Feudalism	Capitalism	Communism
Main technology	tools	tools, manufacture	manufacture, machine	???
Form of product	use-value	use-value/ exchange-value	exchange-value	use-value
Purpose of production	production for needs	production for needs	production for surplus	production for needs
Form of socialization	social production, regulated by blind rules	political regulation, guilds and estates, partly markets	independent producers, market regulation	social production regulated by conscious plan

FIG. 4.3

4.3.2. Structural coupling

The elements in the model outlined above of a machino-capitalist hypercycle are partly material-physical, partly social. Only capital is a social relation, as Marx never tires of reminding us. According to him, it would be completely fallacious to conceive capital exclusively in a definite, palpable form such as money-capital, machinery, buildings, etc. As already indicated, technology cannot be conceived of as a social system.

It might be useful to approach the problem from another viewpoint; this time the focus is on the interplay or 'structural coupling' of social systems in their environment.⁴⁷ Recall the

emphasizes the character of tools for distinguishing historical epochs; see Welskopf 1974.

⁴⁷ See Maturana: 'In the history of interactions of a composite unity in its medium, both unity and medium operate in each interaction as independent systems that, by triggering in each other a structural change, select in each other a structural change. If the organization of a composite unity remains invariant while it undergoes structural changes . . . its adaptation is conserved . . . In other words, if a composite unity is structurally plastic its conservation of adaptation results in its maintained structural coupling to the medium that selects its path of structural change' (Maturana 1980: p. xxi). Luhmann's theory also offers the possibility of a 'structural coupling' of different social systems. He discusses this in the chapter on 'Interpenetration' in his *Soziale Systeme*; see Luhmann 1984a.

passage from Max Scheler cited in section 3.3 (with my addendum regarding politics) where the drive towards domination of nature was conceived as the outcome of the following interactions: the scientist wants to construct all possible machines; the engineer wants to construct all workable machines; the entrepreneur wants to construct all profitable machines; the politician wants to construct all machines which enhance legitimation. If we transform this model from the level of interaction between individuals to the systemic level, we see the interaction of three different social systems: economy, politics, and science.

Technology is an emergent entity, a complex; it springs from the interplay of these social systems. Because of the durability of technical artefacts, technology is an enduring phenomenon. As part of second nature, it belongs to the environment of all societies; modern societies are additionally characterized by the fact that their social subsystems 'include' technology. The 'interaction' between technology and social subsystems is not symmetrical; it is not the case that all three subsystems pull and push technology with the same power, in the same direction, or with the same success (see again s. 3.3).

From this model, a 'technological trajectory', but no technological determinism, can be derived. This is so for the following reasons. Every system operates according to its own rules and expectations about the operations of other systems. For example, the economy has to take into account that the legal context may change in the near future, that new scientific inventions will become available, or a technological solution. Politics may try to resist or enhance certain technologies, scientific work, or economic activities. Science observes that a specific discovery would elicit massive financial rewards so concentrates on a specific research path. Each systemic operation takes time. Meanwhile, the *Stoffwechsel* takes place with technologies which are available. Small improvements and changes occur during their daily application. This explains the existence of a 'technological trajectory'. A technological revolution may occur either as a result of cumulative changes within a technological trajectory, or as a result of scientific discoveries which become applicable to transformation processes. However, technological determinism is excluded, since there are economic, political,

and scientific incentives at work, which lead to a change of technology.

To summarize my criticism of the base-superstructure model:

1. The concept of relations of production lacks precision. It encompasses economic, legal, and social meanings. In order to make it more precise, it should be decomposed into its constituent parts.

2. The concept of superstructure is misleading since it uses a metaphor which suggests a picture of a building with more and less important floors. It suggests that the base (ground floor) could exist without the superstructure (first floor).

3. Cohen's interpretation tries to avoid some of the difficulties by proposing a functional relationship between the elements. Thus we have a primary layer of productive forces which explain the relations of production which explain the superstructures. But superstructures stabilize relations of production which in turn stabilize productive forces. This functional analysis fails on the grounds of its own premiss, that is, to explain productive forces in asocial terms.⁴⁸

4. My own position, in contrast, concurs with the approach that there are some functional links involved in Marx's model but it defines the units in a different way. The most important difference is to rob technology of its autonomous status; in my view, only social systems enjoy such a position. Moreover, social systems can be defined independently from each other, which avoids problems of variable discretion. Circularity is involved in their self-production (which is no defect of the theory!), but is not involved in the relation between them. Yet, the question remains: which productive forces will be suitable for communism? Will they take the form of machinery which *per definitionem* degrades human beings and natural environment? According to evolutionary theory, a new, 'liberating' technology cannot be brought about by intentional action alone, rather, its hypothetical emergence would be the result of the interplay of the economic, political, and scientific system. Let me present a short scenario to illustrate this line of thought and its illuminating and critical potential.

⁴⁸ See Lukes 1983 for a similar critique of the separation of the superstructure from the base.

Politics does not stand at the top of a (pyramidal) society nor in the centre of a (concentrical) society: it is one social subsystem among others. This is to say that politics cannot be expected to cure modern societies of the disease of ecological problems. This would presuppose at least the following:

- it would have to be able to provide a self-description for society which is accepted by all;
- it would have to give an uncontested account of the reasons of ecological problems;
- it would have to put into practice the conclusions reached (cf. Luhmann 1988d, 1989c).

What politics does is to decide on public issues in a binding way. Where an ecological problem is the result of a logic of public goods, politics seems to have some power to resolve it. Examples are cases where ecological problems are manifest and where the obviation of them is feasible by a combined policy of threats and offers, for which Hillel Steiner coined the term 'throtter' (see Steiner 1974 and Taylor 1982; see also ch. 1 above). These decisions may also have effects on the economy or on science, but not in a direct way. We know of many cases where such attempts have proved to be dysfunctional. But there are also examples of successful political interventions (see Rottleuthner 1989; Scharpf 1989). If politics takes a specific decision, this will be perceived by science and economy with their own specific logic (see von Foerster 1981, who defines cognition as computation of computation of . . .). How can we, then, imagine the emergence of a 'virtuous circle' here?

In an interesting study, Beck (1988) reformulated the Marxian categories of relations of production and productive forces. He conceives of the late twentieth century's reality as characterized by a conflict between productive forces and relations of definition (*Definitionsverhältnisse*) and suggested that a central issue in the ecological problematic is the threshold values (*Grenzwerte*) which are established for every substance which is considered toxic or otherwise dangerous. Such thresholds are defined by scientists and technical experts—politicians are laymen in this process. It is often said that the definition of thresholds is rather a political than a 'rational' decision. However, as I try to explain, there are no uncontested standards of rationality. Each system has

its own. Thresholds often are just the establishing of a comfortable working hypothesis which serves certain industries and research departments and which has been adopted by politics. Politicians here either play the part of active accomplices or—in a case where they really want to change something—are simply incompetent. But imagine that critical scientists, engineers, parts of the public, and 'green politicians' succeed in keeping the thresholds considerably down. The result would be real 'political' thresholds being much lower than technological or scientific thresholds. The industries concerned might protest, but if the policy is successful, investments will flow into less damaging technologies and substances, thereby reducing or eliminating the production of dangerous substances. However, it should be noted that this process is recursive, since it is not realistic to expect feasible production processes which are completely free from dangerous substances. This would be possible only in an *ecological Utopia*, ultimately depending on the power of scientific knowledge. In the last instance, only a society which is in the possession of full knowledge could be expected to be a society without ecological problems.

Returning to the problem of intersystemic communication, on the basis of this scenario the establishment of a threshold value would be a social communication which links up the economic, the political, and the scientific system. A communication on threshold values is at the same time an economic, political, and scientific communication. As Teubner has pointed out, structural coupling of different social subsystems is possible for three reasons. First, these subsystems are all based on meaning; second, they all use communications as basic elements for their systems building. And third, every special communication in one subsystem may at the same time be a general social communication (cf. Teubner 1989a: 107). Teubner gives the institution of contract as an example where three types of social actions coincide when a contract is made: economic, legal, and life-world communications (see *ibid.* 133f.). In the case of a communication on threshold values, the political, the scientific, and the economic system are involved, and the communication is at the same time a general social communication in which the political public takes part.

4.3.3. Summary

On a Weberian account, as briefly pointed out in section 4.2.3, an elective affinity between capital, machinery, and science obtains which explains the fusion of these elements in capitalist society.⁴⁹ On the basis of Eigen and Schuster's account, this process can be described as a hypercycle. Stripped to its essentials, manufacturing and machine technology, movable capital, propertyless workers, competition, and extension of intercourse would be the elements of the hypercycle. Capital is the self-replicative unit, the others are 'catalytic links'. According to autopoietic theory, capitalism is a social system which reproduces itself (in Marx, the elements are values, in Luhmann, the elements are payments); it reproduces the system by the production of its elements and it produces its elements by its elements. Taking these three approaches together, we can say that an autonomy of technology exists in none of them. Additionally, one important conclusion is that a causal explanation is not attainable and that the success of functional analysis depends very much on the precise formulation of the problem and the basic units of analysis.

4.4. An empirical illustration: the transition from feudalism to capitalism

In this section, I trace some of Marx's analysis with respect to the transition from feudalism to capitalism, thereby also showing that a causal analysis is not feasible.

Marx never developed fully a historical account of the emergence of capitalism. He was mainly interested in the logical preconditions of capitalist production. Thus he restricted his historical sketch at the end of *Capital* i. to demonstrating how capital and labour power came into existence. However, there are some pages in the *German Ideology* (see CW v. 66–81) and in the *Grundrisse* which can be exploited for my purposes here (I shall rely mainly on the passage from the *German Ideology*).

⁴⁹ This is, of course, not Weber's precise thesis, which, as is known, analyses the relation between *religions* and economic forms.

Marx gives the following picture of the dynamics of capitalist production under the regime of the guilds and other feudal bonds. The premiss is an ever-greater division of labour which separates town and country, commerce and industry, and branches of industry. The result is the extension of communications⁵⁰ which are particularly important for the development of the productive forces. 'As long as there exists no intercourse transcending the immediate neighborhood, every invention must be made separately in each locality . . . In primitive history every invention had to be made daily anew and in each locality independently' (CW v. 67).

With the establishment of the world market and large-scale industry, 'the permanence of the acquired productive forces [is] assured' (CW v. 67), Marx assumes.⁵¹ However, the empirical starting-point for the evolution of capitalism is the manufacture of weaving. This first and most important branch of manufacture uses machinery. The rising demand for clothing gave weaving a big stimulus. A new class of weaver came into existence in the towns. Because of its very nature weaving resisted the trammels of the guilds; it was carried on mostly in villages and market centres without guild organization. Merchant capital, and capital of manufacture, created a mass of movable capital. At the same time, peasants and vagabonds provided the army of the work-people. The discovery of America and of the sea-route to India led to a new impetus for manufacture; the import of gold and other precious metals gave an additional stimulus to the creation of movable capital. Commerce and navigation led to the establishment of the world market, albeit in a restricted form, because of its splitting up into separate parts, each of which was exploited by a particular nation. Real competition between nations was prevented.

Marx distinguishes the above two forms of manufacture and commerce as two distinct historical periods. The third period, then, is large-scale industry. It had to respond to the ever-increasing demand for manufactured products. According to Marx, several preconditions must be fulfilled for this mode of

production: application of natural powers in industry, machinery, a huge division of labour, freedom of competition inside the nation, and the development of theoretical mechanics. We may interrupt Marx's outline at this point and ask ourselves: what sort of explanation, if any, is employed?

Marx gives an account of how a new form of production drives out another form: 'Hence the decline of the guilds as soon as they come into contact with manufacture' (CW v. 70). This seems to be an argument on the level of selection. Taking Elster's five points from above, and equating (Y) with the advent of manufacture, (X), with some needs of feudal society, (Z), we then have to ask how condition (5), i.e. the feedback loop by which Y maintains X through Z, can be fulfilled.

At first sight, there seem to be many *causal* relations at work: needs giving a 'stimulus', discovery of America providing the 'impetus', etc. On the other hand, Marx speaks of preconditions for this development (freedom of competition, natural sciences, machinery, wage-labour). But these preconditions are themselves products of historical processes. Whatever these are, we are not able to identify a prime mover (or first cause) which sets into motion the whole process. Besides, the picture does not resemble a chain reaction, but, rather, a network in which all elements influence all the others. It seems as if increasing demand ('human needs') is the motive power behind the whole. But since demand is only effective as *economic* demand, there must be a prior income which can then show up as demand. It thus seems as if we are lost in vicious circles and infinite regresses: capitalism still does not get off the ground.

Let us therefore change the text for a moment. In *Capital* i, Marx tells us that English feudal lords transformed their agricultural land into pastures for sheep to graze which in turn was caused by the flourishing of Flemish wool manufacture, followed by a consequent rise in wool prices. In fact, the whole 'clearing of estates' created a propertyless class of free labourers. But apart from the economic motivation (i.e. Dutch competition), there is a political factor (the dissolution of feudalism) and a religious-political factor (the dissolution of the property of the Church). These are all historically contingent events.

On this basis we still do not get a coherent explanation. Every string we catch dissolves into many threads; every line we

⁵⁰ The German 'Verkehr' is usually translated as 'intercourse'.

⁵¹ Somewhat naïvely, we might add today, standing on the shoulders of Merton. As Douglas (1986) has pointed out, multiple discoveries and institutional forgetting are complementary processes which also take place in modern times.

follow reveals itself as a circle.⁵² The most reasonable approach would thus be to take the preconditions of capitalism as historically contingent and analyse only the self-enhancing processes which eventually created modern capitalism.⁵³ Since his theory tells him that the capital-labour relation is essential for understanding capitalism, Marx restricts historical analysis mainly to the point where the emergence of those two elements (and their constitution as a social relation) takes place.

And yet there seems to be a privileged element in Marx's account. This is technology. He starts the historical sketch in the *German Ideology* with a glance at the division of labour. He states that the biggest division between manual and mental labour is the division between town and country. In the countryside, outside the control of the guilds, evolves the system of manufacture.⁵⁴ Marx knows with Hegel and Adam Smith that manufacture with its division of labour is far more efficient than the earlier system of craftsmanship.⁵⁵ But the guilds prevented manufacture from growing up. Here we have an example for Marx's claim that social institutions may 'fetter' productive forces. Historical evidence told him that the drive of the productive forces is stronger than the repression of social institutions. The guilds were simply bypassed and had to bow later before the rise of manufacture. This is the 'technological bias' in Marx's analysis. However, technology is always embedded in specific

⁵² Neo-Darwinian biology seems to have the same difficulty in explaining how the 'closure' of the hypercycle is brought about. 'The inevitable question which follows is how the hypercycle is closed off; how it emerges is described often in a not very precise way' (Ballmer and von Weizsäcker 1974: 241, my trans.).

⁵³ Marx would probably have insisted on a more law-like account. In the *Grundrisse*, and *Capital*, he establishes some evolutionary stages of the development of social forms which emerge from each other 'out of necessity'. But it is not clear whether this applies also to technical forms, i.e. whether production based on artisanship had to give way to manufacture and *only* to manufacture.

⁵⁴ When he describes the emergence of movable capital, of wage-labour, of competition, and of the establishment of a 'cash nexus' (X for short) he always presents it in the form of 'With the advent of manufacture, X also occurred'. These are clearly concomitant processes which are not caused by manufacture although it may seem that manufacture was the 'subject' of this process. In the *Grundrisse*, he speaks of a process of dissolution which brought about the elements or preconditions for capitalism (see *Grundrisse* 496 ff.).

⁵⁵ See the famous pin-making example of Adam Smith as cited in Hegel's early *Jenaer Systementwürfe*, see Hegel 1975: 323.

social relations, in this case within the capital-labour relation. I thus conclude that it was part of Marx's implicit research programme to examine social relations and productive forces in their coevolution. A confirmation is the transition from manufacture to modern industry. As already noted, Marx here assigns a degree of importance to social factors (see *Capital* i. 347, 361, and *MEGA* II iii. 6. 1973).

But to come back to the functional analysis: what sort of relations of production were functional for the development of the productive forces? As we have seen, in manufacture (and even more in large-scale industry) the capital-labour relation was the important, dynamic social relation. Relations of production which are functional for this relation must thus secure: (1) private property in the forms of free labour and free capital; (2) free-market competition; (3) an institution which secures both (1) and (2), namely the modern state.⁵⁶

However, Marx does not stop with this account. Within the technical form of manufacture a new technology arises which will take the place of the old: this is large-scale industry based on machinery. Manufacture already used machines in its production process. Eventually, manufacture also produces machines which are able to produce machines. Once this task is accomplished—manufacture has performed its 'historical service'—it becomes superfluous. The new productive forces of modern industry no longer depend on crafts of any sort. This is certainly a suggestive picture which has not lost any of its power. But perhaps Marx was led astray by the implicit suggestion that machinery itself was self-reproductive. In the language of Eigen and Schuster, it would have evolved from a 'functional linkage' into a 'self-replicative unit'. But there are severe theoretical difficulties in supporting such an assumption, not to speak of its lack of plausibility. Even a fully automated industry, which employs robots instead of human labour power, cannot be said to be only

⁵⁶ On this analysis the *democratic form* of the modern state is a contingent event. To be functional for the productive forces, it is sufficient to secure private property and competition. To be sure, there are historical reasons which made the democratic form of the state necessary, e.g. the anti-feudal, anti-authoritarian, pro-science, and, in some countries, pro-Enlightenment conjuncture. See also Barrington Moore's analysis (1966), which stresses the importance of class-constellations for the final shape of specific political forms of capitalism.

produced by machines. This kind of technology is also linked to science, politics, and the economy.⁵⁷

4.5. Evolution of technology and social institutions under ecological constraints

In the following discussion, I want to come back to the question of historical progress and the criteria for measuring it. First of all, I want to stress that under present conditions we are faced 'with a *new* kind of "contradiction between the development of the forces of production and existing social productive relations" which appears . . . in all industrial societies', as Schefold (1977: 247, my emphasis) so aptly put it.

If we accept the terminology of the 1859 *Preface*, we can no longer assume that modern societies have to adapt their institutional arrangements to the productive forces but that they have to attempt to shape the productive forces in a way which makes their detrimental effects upon the natural environment and upon human beings decrease. The social institutions and the productive forces have to become reflexive if the original claim of development and progress is to be sustained. Traditional Marxist analyses assumed that the institutional change would be tantamount to the abolishing of private property relations. This solution is fatally flawed in the light of ecological problems.

But not even a sophisticated author like G. A. Cohen allows these considerations sufficient room in his interpretation of historical materialism.⁵⁸ We would be ill advised if we adopted his outline for the discussion of ecological problems since it offers only the perspective that class struggle might fight out the contradiction between productive forces and relations of production until new social relations have been established which are propitious for the productive forces. But it seems that in the case of ecological problems it is the very nature of some

⁵⁷ It is a common theme in science fiction to assume the contrary, i.e. technology completely beyond the control of social relations. This persistent metaphor takes its force from a deep anthropological 'fear' of the machine. The machine is something between the living and the dead; cf. Bahr's stimulating book (1983).

⁵⁸ I say 'sufficient' because there is a degree of awareness of the problem (see below).

productive forces which causes considerable ecological damage. Hence, if we would rely on their 'autonomous' development, we would be left witnessing even more disasters.

Late capitalism is still characterized by a productivity which the green fundamentalist Bahro called 'frightening' (at a time when he was still a critical Marxist, see Bahro 1977: 9, 51). If we judge the performance of capitalism on the basis of economic or technical criteria (productivity), there is no reason to assume that a new social form would be required to 'unfetter' a development of the productive forces. Marxism, interpreted in such a scheme of productive forces/relations of production, loses all of its critical impetus. However, in my opinion, there is still much justification for claiming exactly such a critical dimension for Marxism. In order to do so, another theoretical reference point will be needed. As I have pointed out, it is crucial for such an approach to incorporate non-economic criteria into our standards of measuring progress. Since Marx did so, we have the possibility of endorsing this dimension in judging how successful a mode of production is in transforming nature.

It is not the institution of private property which fetters the development of the productive forces; and, on the other hand, it is not the institution of state planning which has led to an unfettered development of the productive forces either in the wide (domination of nature) or in the narrow (economic) sense. Ironically, the history of the last seventy years has shown that it is still the capitalist arrangement which develops the productive forces (at least in the narrow sense) best. And, even worse for the performance of socialist planning, the socialist arrangement of the productive forces did not prevent the emergence of severe ecological problems. If socialist countries had a slower development of productive forces, it was *not* because they adopted an ecological policy which consumed part of the resources necessary for the development of the productive forces.

Marx employed ethical and physical arguments when judging historical forms of society. With respect to the first, he stated unequivocally that people were happier in previous modes of production:

At first sight there is a certain ambiguity in the conditions under which the capital relation originally appears (or which appear as historical preconditions of its becoming): on the one hand dissolution of lower

forms of living labour, on the other dissolution of happier relations of the immediate producer. On the one hand dissolution of slavery and serfdom. On the other dissolution of that form in which the means of production are owned by the immediate producer in that his labour is directed primarily either towards use-value (agriculture) or towards exchange-value (town labour). Finally dissolution of the form of community [*Gemeinwesen*] in which the worker as an organ of this natural community was simultaneously owner or possessor of his own means of production. (MEGA II. iii. 6. 2288)⁵⁹

With respect to the second problem, he held quite an optimistic view, as I argued in Chapter 2. Capitalism, he thought, displays the inherent tendency to recycle waste if it is cost-reducing. On the other hand, things which have no price are likely to be wasted under capitalism—examples are air, water, and, most importantly, human beings. It is their flesh, blood, and nerves which capitalism wastes in an unprecedented way if it is not prevented by law.

Considering the present conditions of industrially developed countries, this account seems to be questionable; but I claim that the premiss on which it is built is still valid. The premiss is the following: out of a given set of costs, capitalists try to reduce each factor, be it labour or raw material. This premiss is as valid today as it was a hundred years ago. The difference lies in the different structure of costs (relative prices). In Marx's time, labour was a relatively cheap factor which has now become much more expensive. Raw materials, on the other hand, have not become cheaper in general: some raw materials have become cheaper, some more expensive, some are free (or nearly free), as they were in Marx's time (air and water). Certainly, labour has become protected by law. It therefore cannot be wasted in the same way as it could a hundred years ago. On this different empirical basis, we obtain results different from Marx's. Today we witness the depletion of natural resources which are only

⁵⁹ Cf. the early formulation in the *Holy Family*: 'In the modern world each person is at the same time a member of slave society and of the public commonwealth. Precisely the slavery of civil society is in appearance the greatest freedom because it is in appearance the fully developed independence of the individual, who considers as his own freedom the uncurbed movement, no longer bound by a common bond or by man, of the estranged elements of his life, such as property, industry, religion, etc., whereas actually this is his fully developed slavery and inhumanity' (CW iv. 116). See also Rosdolsky 1968: 488 ff.

partially recycled, apart from extinct animal species. It goes without saying that only the relatively expensive raw materials are recycled by capitalists.⁶⁰ The cheap ones are wasted. It is completely rational for a capitalist (as for a private consumer) to throw away what would require some labour time to restore its use-value if he can readily buy the material at a comparatively low price. If a capitalist has the alternative of buying one ton of a metal or of extracting it from a salt which comes out as waste from his production process, he will decide on the basis of relative prices. Similarly, the private consumer throws away his TV set when costs of repair exceed a certain percentage of the costs of a new TV set.

At the same time, we observe another tendency in this process: the tendency to replace expensive raw materials with cheaper raw materials. The result of this is that man to an ever-greater extent mediates his *Stoffwechsel* with nature by a process which transforms nature ('raw material') into artefacts. Ecologists doubt that this success in transforming nature is a rational one. If one compares the efficiency of production as an economic process with its efficiency as a technical process in so far as it involves energy, we may find that there is a discrepancy (see Schefold 1977). Economic rationality may have to be replaced, or supplemented, by an energy-conscious rationality. Cohen, at the very end of his book, dedicates some attention to this problem. He admits that 'if resources are to be used more sparingly, recourse to them must to some extent be replaced by continued reliance on human labour power' (Cohen 1978: 323). Is this a reason to be pessimistic about post-capitalist society, since the promise of increased leisure cannot be fulfilled? Not at all, replies Cohen. Such pessimistic 'reflections depend on a crude concept of leisure . . . By "leisure" we have meant freedom from unwanted activity, not freedom from productive activity. That the two have gone together under capitalism does not mean that they are fated to coincide in the future' (ibid. 323). As we shall see in the next chapter, this distinction is an illuminating one, but one with which Marx was already familiar.⁶¹

Victor (1980) also maintains that Marx's framework entails

⁶⁰ I do not consider here *public* recycling of paper, glass, etc.

⁶¹ It thus does not run 'against a deep current of thought in Marx', as Cohen supposes (see Cohen 1978: 323).

the physical dimensions of economic processes. After criticizing neo-classical economics for its blindness with respect to ecological problems, Victor holds that Marx's 'broadly conceived analytical framework is not open to the same criticism . . . that can be levelled at the neo-classical framework' (Victor 1980: 207). Neo-classical economics have had only one major contribution which recognized the problem; this was Kenneth Boulding's article 'The Economics of the Coming Spaceship Earth'. As Victor put it, Boulding 'pointed out that the economic activities of consumption, production, and trade involve a rearrangement of matter and not a creation of new material' (ibid. 198). But this approach is hardly new for someone familiar with Marx's theory:

This new approach to economic activities is particularly insightful for analysing environmental issues. It may be surprising to discover, therefore, that in fact it is not really a new approach at all. Economists as distinct in their orientation as Alfred Marshall and Karl Marx devoted substantial passages in their respective treatises to a description of economic activity in precisely these terms. (ibid.)

This leads me to the core of Marx's theory. I maintain that Marx throughout his work endorsed an ethical theory on which his analysis and scientific edifice rest. This ethical theory can be summed up in the following way.

Marx's main concern regarding mankind as a whole, and individual human beings, was to search out the possibilities for an abolition of all 'enslaving effects' which would fetter the development of individuals in a universal way. For example, he writes in the *Theories of Surplus Value* that people under capitalist conditions are 'dominated by the pressure of an extraneous purpose which must be fulfilled, and the fulfilment of which is regarded as a social duty' (TSV iii. 257). In the *Grundrisse*, Marx defines 'real wealth' in terms of individual self-realization, a process which includes an increasing domination of nature and is at the same time an *ongoing* process, that is, a process which has no halting point. This passage synthesizes his philosophical anthropology with perfectionism and his conception of emancipation.

[W]hen the limited bourgeois form is stripped away, what is wealth other than the universality of individual needs, capacities, pleasures,

productive forces, etc., created through universal exchange? The full development of human mastery over the forces of nature, those of so-called nature as well as of humanity's own nature? The absolute working-out of his creative potentialities, with no presupposition other than the previous historic development, which makes this totality of development, i.e. the development of all human powers as such the end in itself, not as measured on a predetermined yardstick? Where he does not reproduce himself in one specificity, but produces his totality? Strives not to remain something he has become, but is in the absolute movement of becoming? (*Grundrisse* 488)

Social division of labour in class societies is most likely to initiate extraneous purposes. Marx, writing on a future communist society in the *Critique of the Gotha Programme*, asserts that 'in a higher stage of communist society . . . the enslaving subordination of the individual to the division of labour, and therewith also the antithesis between mental and physical labour [will have] vanished . . .' (SW iii. 19). As we have already seen, Marx thought that people were happier and freer in earlier modes of production. But pre-capitalist conditions where the worker owns his means of production typically exclude (1) concentration of means of production; (2) co-operation; (3) division of labour within one production process; (4) social mastery and regulation of nature; and (5) free development of social productive forces (see *Capital* i. 714).

Marx thought that it is possible, probable, and even inevitable that mankind will reach a non-enslaving mode of production in socialist society. Socialist society would synthesize the moral level of ancient societies with the achievements of modernity; it would combine the concern for use-value production (quality of products) of antique society with the general availability of commodities in modern capitalist society (quantity).⁶² In the *Grundrisse*, he says that only under modern conditions does an interest arise in what sort of property yields maximum wealth; in ancient Greece, the interest was in which sort of property yields the best citizen (see *Grundrisse* 487).

The historical condition for the fusion of 'happiness' with

⁶² In the *Manuscripts 1861-3* Marx examines ancient Greek thinkers like Xenophon, Plato, Aristotle, and Thucydides. They were concerned with the quality of products (use-values); therefore, it was assumed that each man should dedicate himself only to one art or work.

'material wealth for the greatest number' would be a sufficient level of productive forces which frees man from wrestling with nature to a large degree. Capitalism was the mode of production which served this purpose. Thus Marx praised capitalism for the development of the productive forces. But capitalism still does not bring about a full 'social mastery and regulation of nature'. People are still the pawns in a mechanism which they do not understand. As Marx emphasizes, there is a paradoxical tendency at work:

In our days, everything seems pregnant with its contrary. Machinery, gifted with the wonderful power of shortening and fructifying human labour, we behold starving and overworking it. The new-fangled sources of wealth, by some strange weird spell, are turned into sources of want. The victories of art seem bought by the loss of character. At the same pace that mankind masters nature, man seems to become enslaved to other men or to his own infamy. Even the pure light of science seems unable to shine but on the dark background of ignorance. All our invention and progress seem to result in endowing material forces with intellectual life, and in stultifying human life into a material force. (CW xiv. 655-6)

This paradoxical tendency, this regress within progress, made Marx condemn capitalism. It is a social form which makes people suffer, which has an irrational performance (economic crises), and reifies social relations. This condemnation is a moral condemnation, even if Marx refused to accept such a label. He often endorses an ironic attitude, as when he cites Goethe's poem 'An Suleika'. Marx refers several times to this poem. He attributes it to the propagators of capitalism and to the capitalists themselves when he exposes the misery produced by capitalism. Confronted with the number of dead workers in mines, they would, according to Marx, respond with the poem which reads as follows:

Sollte diese Qual uns quälen,
Da sie unsre Lust vermehrt,
Hat nicht Myriaden Seelen
Timurs Herrschaft aufgezehrt?
(Should this torment worry us
it increases our delight,
did not the souls of myriads
eat up Timur's might?)

Marx, in turn, uses the same poem in the opposite sense, stressing above all the third and fourth verses which refer to the expectation of a socialist revolution. This use of the poem is a clear instance of Marx's view that history until the advent of socialist society is a natural process in which a certain number of souls have to be sacrificed in order to achieve the downfall of the tyrant. Of course, one can characterize this position as simply describing ('value-free') a mechanism; but only the underlying evaluation (sacrifice, tyrant) provides meaning (for the social scientist) and motivation (for the oppressed masses). It is thus a moral condemnation, because someone who is interested exclusively in the level of productive forces has no reason to condemn the social form which is beneficial to that development, if this social form goes along with a development of the productive forces both on average and in the long run. If the setbacks are only temporary or so small that they cannot reverse the general direction of the development of the productive forces, there would be no reason to object to such a development. But Marx is not concerned about 'net gains' of the sum total of progress and regress. The point is that both notions have many dimensions which make it difficult to scale or quantify them.

Marx does not share the criticisms of modernity which would like to abolish modern technology and modern conflicts. Against such backward-orientated positions, Marx says: 'On our part, we do not mistake the shape of the shrewd spirit that continues to mark all these contradictions. We know that to work well, the new-fangled forces of society, they only want to be mastered by new-fangled men—and such are the working men. They are as much the invention of modern time as machinery itself' (CW xiv. 656). Nietzsche's *Übermensch* comes to mind here, but also Marx's dictum that people only set themselves tasks which they are able to fulfil. The emergence of Marx's 'superman' is a process which can be determined technologically: since the productive forces of capitalism are universal ones, the producers who appropriate them are becoming universal individuals.

If one accepts this interpretation of Marx's theory, one understands better the question of ecological problems and their relation to productive forces. If Marx's ultimate concern was the abolition of enslaving effects and the bringing about of a social form which organizes its transformation of nature in a rational

way, he would have had to take into account the possibility that man's very *Stoffwechsel* with nature entails the danger of 'enslaving effects'. Marx seems to overestimate the degree of a successful social mastery of nature under modern conditions. But, conversely, he is aware of severe ecological problems which arise under *capitalist* conditions. However, we may doubt whether Marx's own position offers a perspective here. As he states in *Capital*, a higher synthesis of agriculture and industry, i.e. the unification of town and country, would avoid disturbances in the process of *Stoffwechsel* (see *Capital* i. 474).

In his view, it is modern industry which frustrates such a higher synthesis: 'The more a country starts its development on the foundation of modern industry, like the United States, for example, the more rapid is this process of destruction' (*Capital* i. 475). This is another instance where Marx seems aware of the possibility that the very nature of a productive force might cause huge undesirable effects, that is, that it is not only the capitalist form which is responsible. But this would create insurmountable difficulties for his theory. He thus adds immediately: '*Capitalist* production, therefore, develops technology . . . only by sapping the original sources of all wealth—the soil and the labourer' (*Capital* i. 475). With respect to the detrimental effects of modern industry on human labour power, Marx tried to make his analysis consistent in the final version, i.e. in *Capital*, as we have seen in section 3.6. With respect to detrimental effects of modern industry on the natural environment, Marx's analysis remains ambiguous: it allows for both possibilities, blaming the productive forces *and* social relations.⁶³

According to Marx, a social mastery of nature can be achieved only in communism. As he states in *Capital*, a higher synthesis of agriculture and industry would avoid 'disturbances' in the *Stoffwechsel* between man and nature. The miserable state of the natural environment, the separation of the globe into agricultural and industrial zones, the dangers arising from the present methods of transforming nature indicate clearly that

⁶³ Recall Marx's statement on the 'greedy farmer [who] snatches increased produce from the soil by robbing it of its fertility' (*Capital* i. 253). Also, here, it is not a specific social relation (for example, capitalism) which exhausts the soil but a behaviour which may occur under several social relations, under relations which exacerbate a greedy attitude towards nature.

mankind has not yet succeeded in mastering nature. We may thus regard the solution of ecological problems as a test case for communism, that is, only that social form which succeeds in incorporating reflexivity into its *modus operandi* will be worthy of being called 'communist'.

Marx did not pay enough attention to the possibility that technological and scientific progress need not be paralleled by social progress. He partly followed the optimistic tradition of the Enlightenment (Bacon, Descartes) which assumed such a parallel (see Leiss 1972). But Marx was also deeply influenced by (German) romanticism. This tradition informed his theory of the moral evolution of mankind (from a non-alienated primordial state to personal dependence, to impersonal dependence, to total freedom).⁶⁴ Since Marx took for granted that history would inevitably lead to a final reconciliation in communist society, he could formulate the relation between productive forces and social institutions as a law-like relation which will lead to communism. If we, basing ourselves on historical evidence, challenge this assumption, we can nevertheless derive the criteria for the superiority of communism from Marx's own framework: only a society which is able to calculate the results of its own work and function fulfils the condition of being a communist society.

⁶⁴ See *Grundrisse*: 'Relations of personal dependence (entirely spontaneous at the outset) are the first social forms, in which human productive capacity develops only to slight extent and at isolated points. Personal independence founded on *objective* dependence is the second great form, in which a system of general social metabolism, of universal relations, of all-round need and universal capacities is formed for the first time. Free individuality, based on the universal development of individuals and on their subordination of their communal, social productivity as their social wealth, is the third stage' (*Grundrisse* 158).

5 Communism

So wird das Problem eines zentral vermittelten Bezugs zur Natur das dringendste; die Tage des bloßen Ausbeuters, des Überlisters, des bloßen Wahrnehmers von Chancen sind auch technisch gezählt. (Ernst Bloch, *Das Prinzip Hoffnung*)

5.1. Twofaces of communism

One conclusion which I have reached so far is that a communist society must be a society which regulates its interchange with nature in a rational way; this is to say that the existence of severe ecological crises would inhibit one from calling such a society 'communist'. This proposition follows from Marx's insistence that human emancipation means not only material abundance and non-existence of wage-slavery but also spiritual wealth (happiness) and conscious control of the individuals over their life-conditions. In what follows I shall focus on a possible ambiguity in this notion of communism. The ambiguity is contained in the last proposition: all depends on how strong a claim is made with respect to conscious control and how the realm of 'life-conditions' is defined. My suggestion is to distinguish between two notions of communism. If we summarize some remarks of Marx with respect to communism in general, we could compile the following list:

1. abolition of private property;
2. abolition of classes, class exploitation, and class oppression;
3. universalization of happiness;
4. universalization of material wealth;
5. expanding of disposable time;
6. return to use-value production;

'Thus the problem of a centrally mediated relation to nature becomes most urgent: the days of the mere exploiter, of the outwiter, of the mere taker of opportunities are numbered even in technological terms.'

7. reappropriation of man's objectifications;
8. total individuals;
9. conscious control.

The dividing line lies somewhere between (5) and (7). The difference between the two notions can be connected to the principles of market and plan and to the presence or absence of *alienation and fetishism*. Whereas the strong notion requires the superseding of alienation, the weak notion would allow its persistence. I return to this difference in sections 5.5.2 and 5.6.

In the *Paris Manuscripts*, Marx himself gives a hint of such a distinction: here he says: 'Communism is the necessary form and the dynamic principle of the immediate future, but communism as such is not the goal of human development, the form of human society' (CW iii. 306). Maihofer (1968) points out this possible difference. It is possible that Marx here refers to 'crude communism', a notion which he also used in the *Paris Manuscripts*. In his later writings he equates the release of all human powers with communism. Nevertheless, there is still a tension within his concept of communism. For example, in his *Critique of the Gotha Programme*, Marx introduces a lower stage of communism, which by later Marxists has been called socialism (cf. Lenin 1917: 472). With this distinction we have again a weak and a strong notion of communism. But before discussing this possible tension, I shall first look at decisive traits of communism 'as such', as described by Marx.

In the *Comments on James Mill* (1844) Marx defines 'human society' as a society which makes possible the full release of human nature:

Let us suppose that we had carried out production as human beings. Each of us would have in two ways affirmed himself and the other person . . . I would have directly confirmed and realized my true nature, my human nature, my communal nature. Our products would be so many mirrors in which we saw reflected our essential nature. (CW iii. 227–8)

Marx contrasts production under capitalist relations with 'production as human beings'; the latter is a synonym for communism. Human beings are characterized as creative and communal beings. Capitalism thwarts the full development of the individuals, although—at least according to the 'official' position developed in *Capital*—it contributes to that development in so

far as it enhances the variety (*Vielseitigkeit*) of work and creates the social-co-operative character of work. A society which enabled the release of all human powers would be 'human society'.

Marx approaches the project of emancipation not from a given 'system of happiness' but rather from the features of human nature. The first approach would be a static and doctrinal one, whereas the second starts from empirical facts and scientific observation, namely that human beings have developed their productive powers, i.e. their domination over nature. Chapter 2 briefly examined the paradoxical and tautological implications in this approach. However, Marx was able to resolve them by distinguishing between a historical and a critical dimension in his enterprise. The critical dimension enables him to judge historical forms of production, including the capitalist form. At times, for Marx the scientific and the normative view converge. In these cases he advances 'Marxism as a science'. For example, the abolition of capitalism is not only desirable for him but real, a 'process which unfolds beyond our eyes' (as he put it in the *Communist Manifesto*).

If a social form 'fetters' the project of mankind to increase mastery over nature, it has to be and it will be replaced by a social form better adapted to that need. The mechanisms which bring about this replacement are equally historically observable *real* forces. In cases where Marx fuses both dimensions, he tries to get around the task of defining communism, since this was troublesome. Consider, for example, his assertion in *Capital* I, where he approvingly cites the monk Ortes of Venice, who said: 'Instead of proposing useless systems for people's happiness, I shall limit myself to investigating the causes of human misery' (*Das Kapital* I. 675–6, my translation). But the exposing of instances of human misery presupposes some notion of happiness. 'Marxism as a critique', therefore, is indispensable in this enterprise.

The reader will note that I am using the word 'fetter' with a different meaning from the usual one. The *locus classicus* for the notion of fettering is the 1859 *Preface*, where it occupies a central place to describe the relation between productive forces and relations of production in the course of history. The standard interpretation of the 1859 *Preface* is mainly about economic criteria, about fetters to the optimal use or development of produc-

tive forces. However, productive forces are embodied in specific technologies and forms of social co-operation. They are the 'expression' or objectification of the creative individuals who strive towards a world which leaves no place for superior powers. This humanist model lies at the heart of Marx's discussion of the relation between productive forces and relations of production. It would be as mistaken to interpret the *Preface* in mere quantitative economic terms as it would be to interpret it in scientific-deterministic terms. It is true that capitalism fettered the development of the productive forces in this respect, too (remember that this was Lenin's central claim in his theory of imperialism), and that Marx also criticized capitalism in this respect. I say 'also' because this was neither his sole nor his most important criticism. In section 4.6, we saw that a spiritual element was always present in Marx's definition of 'progress'. We also saw that a successful *Stoffwechsel* between society and nature has to be included and that the Marxian theory offers the tools for such an analysis. After all, this is the crucial point for the whole debate between Marxists and environmentalists: if Marxism has a narrow, quantitative, 'productivist' notion of what increase in the productive forces means, the environmentalists' challenge to Marxism is completely in order. If, on the contrary, Marxism has a wider notion of the term (and I think it has) then the environmentalists' charge is misplaced. To sustain my argument further, I draw attention to the following critical elements in Marx's thought.

In the *German Ideology*, he draws a contrast between communism and all earlier modes of production. He writes,

Communism differs from all previous movements in that it overturns the basis of all earlier relations of production and intercourse, and for the first time consciously treats all naturally evolved premises [*naturwüchsig*] as the creations of hitherto existing men, *strips them of their natural character* and subjugates them to the power of the united individuals . . . The reality which communism creates is precisely the true basis for rendering it impossible that anything should exist independently of individuals, insofar as reality is nevertheless only a product of the preceding intercourse of individuals. (CW v. 81, my emphasis)

Marx does not yet use the term 'mode of production'. However, as the context makes clear, he is not only talking about a

communist (social) movement but about communism as a social form. Note that the word 'natural' in the quotation does not so much refer to 'nature', but is used in the sense of 'given', 'unchangeable', 'opaque'. Not only nature₁, but also nature₂ can thus have 'naturally evolved' characteristics. The more mankind succeeds in transforming nature₁, the less this is conceived as a mystical power; rather it is seen as something subjugated to the power of the united individuals. This aspect of actively transforming nature becomes of crucial importance here and distinguishes Marx from Feuerbach's passive naturalism. For Marx, nature as such cannot be cognitively captured. As he put it with Vico, we can understand only what we have produced ourselves (see s. 5.5.1).

In *Capital*, Marx again analyses 'natural premisses' and the possibility of treating them as the creations of 'hitherto existing men'. In so doing, he employs the *Stoffwechsel* concept to analyse the relation of society to nature and conceives of human development in the circle of externalization, objectification, and appropriation (cf. Habermas 1987a: 64 ff., 76 ff.). Under capitalism, the circle is interrupted, since the product of the producers does not return to them. Hence, to close this circle, private property needs to be abolished and labour has to be constituted as social labour from the outset. Marx presents four models of non-capitalist production. The first is Robinson's isolated production, the second is feudalism, the third is a patriarchal farmers' community, and the fourth is 'a community of free individuals, carrying on their work with the means of production in common, in which the labour-power of all the different individuals is consciously applied as the combined labour-power of the community' (*Capital* i. 82–3).

Now, this 'community of free individuals' is obviously a synonym for communism. Feudalism and the patriarchal family are both based on personal dependence, with the difference that feudalism rests on an enforced division of labour whereas the patriarchal family rests on a 'spontaneously developed division of labour' (*Capital* i. 82). These rural-patriarchal communities thus could almost be called communist, if they were not founded on the 'immature development of man individually' which is reflected in the 'ancient worship of Nature' (*Capital* i. 83, 84). Historically, these communities have been eroded to the extent

that personal dependence has given way to impersonal dependence, transforming labour power into a commodity.¹

Communism, for Marx, is thus a stage of society in which the united individuals² (freely associated men) act upon their material production and conceive their products as products of their own; not as products of nature, and not as mystical products, i.e. products of capital:

The life-process of society which is based on the process of material production, does not *strip off its mystical veil* until it is treated as production by freely associated men, and is consciously regulated by them in accordance with a settled plan. (*Capital* i. 84, my emphasis)

'Natural character' and 'mystical veil' are interchangeable in the quote from the *German Ideology* (CW v. 81, quoted above) and in the preceding quote from *Capital*—they fulfil the same function in his argument. When Marx says here that production must be 'regulated in accordance with a settled plan', this can be interpreted as a more concrete formulation of the *German Ideology*'s 'subjugation of human creations to the power of the united individuals'. Communism will be the historical stage under which men for the first time supersede the natural character of the *Stoffwechsel*. The preconditions for such a society are the establishment of the world market and the existence of a universal class: the proletariat.³

In this section I touched upon three questions which need further examination. The first is the question of transforming

¹ I employ here the evolutionary scheme from the *Grundrisse* where Marx depicts a development of mankind from personal dependence to impersonal dependence to freedom, see *Grundrisse* 158. The full quote is given in s. 4.5, final note.

² The notion of 'individual' is a modern concept which emerges directly from the dissolution of relations of personal dependence, i.e. when labour power is transformed into a commodity. In other words, members of a patriarchal family are not 'individuals'—or they are individuals only as part of a collectivity. See Luhmann 1989b.

³ Note that both preconditions refer to communicative aspects; the creation of the world market consists in the extension of means of transport and communication; likewise, the proletariat is a universal producing and suffering class which represents the interests of humanity. In contrast to earlier producers, the industrial workers are producing co-operatively, a fact which enhances communication. Comparing countries with different population density, Marx draws attention to the fact that a country with less density may compensate for such a possible disadvantage with respect to productive power by means of communication. See *Capital* i. 333.

nature and the cognitive possibilities which are required for a human society—a question which I discuss further in sections 5.3 and 5.5.1. The second is the question of how this ‘conscious control’ will be organized. Does something like central state planning follow from Marx’s theory (s. 5.5.2)? Closely linked to this topic is the third question: how are the weak and the strong notions of communism linked in Marx (ss. 5.5.2 and 5.6)? But first I shall consider the notion of labour which, according to Marx, forms the link between society and nature.

5.2. Labour

In this section I focus on how Marx conceives of the character of productive activity in communist society. Is it true that he equated labour (as necessary, nature-transforming activity of the human race) with *unwanted* activity? Did he conceive of communist society as a society in which labour has been transformed into completely free activity? Is Marx’s ideal of labour something close to ‘play’? In what follows I shall answer all these questions in the negative.

5.2.1. The critical dimension of the concept of labour

Human beings are natural and social beings. Their life activity (*Lebensäußerung*) is thus not mere transformation of nature, but conscious and creative transformation of nature. In this transformation of nature they realize at the same time their species essence, their human nature. Marx saw clearly that the present conditions of production (capitalist relations) impinge upon the full realization of these human characteristics (cf. *CW* v. 87–8). The abolition of these conditions would thus give rise to the realization of all human powers. This ‘expressivist’ notion of labour (Taylor 1975) is present in all stages of Marx’s theoretical development. What changes is the way he conceptualizes it. In section 2.5.3 I devoted some attention to paradoxical and tautological implications of this expressivism. I argued that Marx resolves the problem by splitting it up. First he analyses historical manifestations of this human essence, and second, he evaluates them on the basis of a notion of human self-realization. This second operation deserves our interest now.

5.2.2. Labour and enjoyment

In my view Marx constantly employed an ideal of labour which was a combination of work and enjoyment. We can find an instance of this approach, for example, in the *Paris Manuscripts* where he writes: ‘In political economy labour occurs only in the form of activity as a source of livelihood . . . [P]olitical economy knows the worker only as a working animal—as a beast reduced to the strictest bodily needs’ (*CW* iii. 241, 242). The alienated state of labour is constituted by ‘the fact that labour is *external* to the worker, i.e. it does not belong to his intrinsic nature; that in his work, therefore, he does not affirm himself but denies himself, does not feel content, but unhappy, does not develop freely his physical and mental energy but mortifies his body and ruins his mind’ (*CW* iii. 274). In the *German Ideology*, writing about the relation between individuals and the productive forces, he states: ‘Labour, the only connection which still links them with the productive forces and with their own existence, has lost all semblance of self-activity and only sustains their life by stunting it’ (*CW* v. 87).

The same general approach is to be found in the *Grundrisse* where he introduces the distinction between labour and play. Marx opposes Fourier who advocates a transformation of labour into play (see *Grundrisse* 712). He maintains that such a transformation would be impossible, and, furthermore, even the most free work (like composing) is a most serious activity (see *Grundrisse* 611).⁴ But Marx also opposes the view of Adam Smith who regards all work as a ‘curse’ and views leisure as the ideal human situation. Against this position Marx puts forward his different anthropology, that is, that man, in his ‘normal state of health, power, activity’, has the need for a normal quantum of work and hence interruption of leisure.

In the sweat of thy brow shalt thou labour! was Jehova’s curse on Adam. And this is labour for Smith, a curse. ‘Tranquility’ appears as the

⁴ Benjamin in his *Passagen Werk* endorsed Fourier’s vision, arguing that once human labour ceases to be exploited, nature also ceases to be exploited and hence work can become play: ‘Once exploitation ceases, labour will strip off its character as nature exploiting. It will then take place according to the model of childlike play which in Fourier forms the basis of the *travail passionné* of the *harmoninens*’ (Benjamin 1982: 456). I return to Benjamin in a moment.

adequate state, as identical with 'freedom' and 'happiness'. It seems quite far from Smith's mind that the individual, 'in his normal state of health, strength, activity, skill, facility, also needs a normal portion of work, and of the supersession of tranquility'. (*Grundrisse* 611)

Although the *Grundrisse* would be seen to turn away from the early writings because of their deliberate 'realist' tone against Fourier, instead they rather confirm the position taken there, namely that labour and enjoyment in principle can, and should, go together; in the *Grundrisse*, we find the formula of 'travail attractif' for this fusion. Marx stresses the need human beings have for work, which may be done in an enjoyable way ('travail attractif') or in a fragmented, alienated, unhappy way (as under capitalism). But Marx clearly opposes the extreme position that labour could be transformed into play. (This Fourierian view employs the same anthropology as Adam Smith. Both regard human beings essentially as 'homo ludens' or at least having a strong 'leisure preference'.)

Let us now examine the concept of labour in *Capital*. Marx starts with a theme which by now is familiar to the reader: man is part of nature, nature is man's inorganic body with which he must keep in contact in order to survive. This *Stoffwechsel* is therefore, in the first place, a necessity rather than a desire. So far as 'labour is a creator of use-value . . . it is a necessary condition, independent of all forms of society, for the existence of the human race; it is an eternal nature-imposed necessity, without which there can be no material exchanges between man and Nature, and therefore no life' (*Capital* i. 50). Note that this approach is already present in the early writings and in the *German Ideology*: 'The worker can create nothing without nature, without the sensuous external world. It is the material on which his labour is realised, in which it is active, from which and by means of which it produces' (CW v. 273).

There can be no doubt that Marx in *Capital*, too, endorses a normative concept of labour. Admittedly, there are some passages in which he seems to praise modern factory work for itself. As my discussion in Chapter 3 has shown, this appraisal has nothing to do with praising stupid, monotonous, or repellent work. The extolling merely refers to the social, co-operative character of production which would serve as a foundation stone of communist society. He praises the capitalist mode of

production for having abolished the life-long attachment of one individual to one profession or branch of activity; he praises the tendency to develop more abilities, and, finally, the essentially co-operative character of industrial production.⁵ On the other hand, Marx is aware of the deskilling and other harmful consequences of these tendencies *under capitalist relations*. Since Marx, in *Capital*, takes great pains to show that potential progress (both in the economic and spiritual sense of the term) is not set in motion as a result of capitalist social relations, it would be foolish for him to endorse a concept of labour which was devoid of any emancipatory element (cf. Honneth 1982).

5.2.3. *The realm of necessity*

Human beings, whether they want to or not, must participate in the *Stoffwechsel* with nature. With this argument, Marx seems to come close to Adam Smith's concept of labour. But does it really follow that he has to give up his concept of 'travail attractif'? A widespread view holds that Marx, at least in *Capital* iii, becomes more pessimistic and introduces the dichotomy of labour and leisure, where the first is alienated, the second free, conscious activity. The two are interpreted as corresponding to the realms of necessity and freedom and it is assumed that the early Marx dreamt of communism as the 'realm of freedom', whereas the later Marx came to acknowledge some undelightful necessities. I think that such interpretations are completely misconceived.⁶ Since the famous passage from *Capital* iii has been the subject of many discussions, I shall devote some attention to it. Marx says:

In fact, the realm of freedom begins only where labour which is determined by necessity and mundane considerations ceases; thus in the very nature of things it lies beyond the sphere of actual material production. Just as the savage must wrestle with nature to satisfy his wants, to maintain and reproduce life, so must civilized man, and he must do so in all social formations and under all possible modes of production. With his development this realm of physical necessity expands as a result of his wants; but, at the same time, the forces of

⁵ I am not sure if Marx proposes here a 'downright silly' position, as Elster (1985: 81) suggests.

⁶ See, also, my own treatment in Grundmann 1988.

production which satisfy these wants also increase. Freedom in this field can only consist in socialised man, the associate producers, rationally regulating their interchange with nature, bringing it under their common control, instead of being ruled by it as a blind power; and achieving this with the least expenditure of energy and under conditions most favourable to, and worthy of, their human nature. But it nonetheless still remains a realm of necessity. Beyond it begins that development of human energy which is an end in itself, the true realm of freedom, which, however, can blossom forth only with this realm of necessity as its basis. The shortening of the working day is its basic prerequisite. (*Capital* iii. 820)

From this it follows very clearly that communism will never be a pure 'realm of freedom'—but the younger Marx did not entertain such a belief either. Marx, both in the 1840s and in the 1860s and 1870s, knew that mankind must transform nature in order to safeguard its existence and he expounded this view several times;⁷ but something else follows from this too.

Marx does not suggest that all that communism can bring about is a significant reduction in labour time. We are led astray if we would equate the reduction of working time with a reduction of the realm of necessity, as many authors seem to do. When Marx speaks about 'development of human energy which is an end in itself' (*Capital* iii. 820), this refers to his earlier treatment of the problem of how human wealth can be conceived. Take, for example, the following passage from the *German Ideology* where Marx draws attention to the definition of spiritual wealth and praises the establishment of the world market as an important element in this respect: 'From the above it is clear that the real intellectual wealth of the individual depends entirely on the wealth of his real connections. Only this will liberate the separate individuals from the various national and local barriers, bring them into practical connection with the production (including intellectual production) of the whole world and make it possible for them to acquire the

⁷ Marx conceives of the realm of necessity and the realm of freedom both in a similar and in a different way from Aristotle. They are similar in stressing the natural necessity of labour as a life-maintaining process; they are different in that Marx does not locate labour in the realm of *oikos*, the private household, to which in Aristotle the nobler *politeia*, the public, corresponds. Marx introduces labour into the public sphere, attributing to it 'noble' characteristics and locating an emancipatory dimension in it.

capacity to enjoy this all-sided production of the whole earth (the creations of man)' (*CW* v. 51). In the *Grundrisse*, he returns to this problem, citing a view which sees in the establishment of impersonal relations an advantage: 'It has been said and may be said that this is precisely the beauty and greatness of it [the world market]: this spontaneous interconnection . . . which is independent of the knowing and willing of the individuals, and which presupposes their reciprocal independence and indifference. And, certainly, this objective connection is preferable to the lack of any connection, or to a merely local connection resting on blood ties, or on primeval, natural or master-servant relations' (*Grundrisse* 161–2). But at the same time he adds a critical judgement:

Equally certain is that individuals cannot gain mastery over their own social interconnections before they have created them. But it is an insipid notion to conceive of this merely objective bond as a spontaneous, natural attribute inherent in individuals and inseparable from their nature (in antithesis to their knowing and willing). This bond is their product. It is a historic product. It belongs to a specific phase of their development. The alien and independent character in which it presently exists vis-à-vis individuals proves only that the latter are still engaged in the creation of the conditions of their social life, and that they have not yet begun, on the basis of these conditions, to live it. (*Grundrisse* 162)

I return in section 5.5 to the 'Vico-argument' contained in this passage. What is of interest here is that the world market is a precondition for the development of human wealth. Communism will not abolish the world-wide connection between producers, but bring them under their conscious control. This is the pre-supposition for mankind's gaining real wealth:

In fact, however, when the limited bourgeois form is stripped away, what is wealth other than the universality of individual needs, capacities, pleasures, productive forces, etc., created through universal exchange? The full development of human mastery over the forces of nature, those of so-called nature as well as of humanity's own nature? The absolute working-out of his creative potentialities, with no presupposition other than the previous historic development, which makes this totality of development i.e. the development of all human powers as such the end in itself, not as measured on a predetermined yardstick? Where he does not reproduce himself in one specificity, but produces

his totality? Strives not to remain something he has become, but is in the absolute movement of becoming? (*Grundrisse* 488)

I take this eloquent list of rhetorical questions as an extended version of the short remark in *Capital* iii, where Marx speaks of the development of human energy as an end in itself. From the above passage it is clear that the development of human powers depends (1) on a given stage of transformation of nature; (2) on human capacities which have already been reached; (3) on new capacities which emerge and on human needs which set in motion the drive for new goals. Or, in the language of *Capital* iii, 'the true realm of freedom . . . however, can blossom forth only with this realm of necessity as its basis' (*Capital* iii. 820). But it follows equally, and this is the stress in *Capital* iii, that mankind for this reason will always have to work. Only a stationary society would allow for the reduction of labour time to an insignificant length. However, Marx leaves no place for a 'stationary state' of society which would have been for him a society restricting human freedom in an unacceptable way. The development of human powers demands the production and reproduction of the conditions necessary for it. The shortening of the working day is the prerequisite for this 'development of human energy as an end in itself', as Marx claims in *Capital* iii. In order further to defend my position that Marx was not content with a simple reduction of working time in communist society, I give two possible readings of this sentence. First, it can be argued that the above claim refers principally to capitalist conditions where labour indeed has an alienated character. The shortening of the working day is a condition for the producers to be able to develop new creative powers and new needs. The working time, the work-load, and the alienated character of labour under capitalism fetter such a development. Therefore, the working day has to be shortened. But if, in a communist society, labour has lost its alienated character, if humans develop their creative potential also in and through the process of production, shortening the working day may be of less importance. Imagine people who already in capitalist society are among the happy few to perform above all creative labour. Many of them would consider a limitation of working time as a restriction of their personal needs and creativity. In a communist society, according to

Marx, surplus labour itself will become a need (see *Grundrisse*, Berlin edn.: 231).

Second, in a passage in the *Manuscripts 1861-3*, Marx asserts that it is a 'law of motion' of human nature to develop new needs once an existing set of needs has been satisfied. Capital is propitious for this trend since it sets free labour in one branch and employs it in others. It develops human capacities in new directions (cf. *MEGA* II iii. 1. 175).

It is often heard that the passage from *Capital* iii would conceive of a possibility of a leap from the realm of necessity into the realm of freedom. Engels, in his *Anti-Dühring*, coined the term 'humanity's leap from the realm of necessity into the realm of freedom'. He argued that with the seizing of the means of production by society, man becomes 'master of his own social organisation' (*CW* xxv. 270). However, Engels's treatment of the matter is based on social aspects alone, as becomes even more clear in the following passage: 'Man's own social organisation, hitherto confronting him as a necessity imposed by nature and history, now becomes the result of his own free action. The extraneous objective forces that have hitherto governed history pass under the control of man himself' (*ibid.*). But Marx, in the above passage, makes an argument about *natural* necessities. He says that human beings, in their development, will expand their wants thus creating a counter-tendency to a decreasing realm of necessity. There might be one possibility for such a leap: if we imagine a 'stationary state' (John Stuart Mill) which is able to produce its wealth in an ever-decreasing amount of time—if its population remains constant and no new needs are developing. This necessary transformation of nature could be done by means of an automated production process. But such a stationary state is completely incompatible with Marx's definition of what human freedom means. It is an integral part of his theory of human nature that humans develop, that they are creative and innovative, that they acquire new needs and knowledge and find new solutions to emerging problems. Consider the following passage from John Stuart Mill:

I cannot, therefore, regard the stationary state of capital and wealth with the unaffected aversion so generally manifested towards it by political economists of the old school. I am inclined to believe that it would be, on the whole, a very considerable improvement on our

present condition. I confess I am not charmed with the ideal of life held out by those who think that the normal state of human beings is that of struggling to get on; that the trampling, crushing, elbowing, and treading on each other's heels, which form the existing type of social life, are the most desirable lot of human kind. (Mill 1909: 748)

While Marx could have agreed with the undesirable traits of industrial society, he certainly would not have agreed with the endorsement of the stationary state.⁸ For example, in *Capital* i, he writes:

Only by suppressing the capitalist form of production could the length of the working-day be reduced to the necessary labour time. But, even in that case, the latter would extend its limits. On the one hand, because the notion of 'means of subsistence' would considerably expand, and the labourer would lay claim to an altogether different standard of life. On the other hand, because a part of what is now surplus-labour, would then count as necessary labour. (*Capital* i. 496)

The point is that Marx is talking about natural limits to the transfiguration of nature which stem from this peculiarly human condition. In other words: the social character of human beings re-establishes anew the natural limits at each stage of historical development. The 'natural limits' are physically given and socially produced (see Hirsch 1977). Since these natural limits do exist, no matter whether physically given or socially produced, there is no place for speculation about mankind's 'leap' into the realm of freedom, as the Marxist tradition has assumed. The standard Marxist interpretation holds that the realm of freedom will be based on material abundance; only with this will it be possible to overcome personal differences. The similarities of this reading to the following observation of Hume are obvious. In *A Treatise of Human Nature*, Hume pointed out that the conditions for justice derive from a specific situation in which mankind finds itself restricted by selfishness and limited generosity of the human mind and scarcity of external objects (see Hume 1964: 266–7). However, among people imbued with mutual affection, things are often rendered common property, as 'married people in particular lose their property and are unacquainted with the mine and thine . . . The same effect arises

⁸ Some recent advocates of a stationary state include Ophuls (1977) and Daly (1980).

from any alteration in the circumstances of mankind, as when there is such a plenty of any thing as satisfies all the desires of men. In which case the distinction of property is entirely lost, and every thing remains in common' (ibid. 267). And: '[I]f men were supplied with every thing in the same abundance, or if every one had the same affection and tender regard for every one as for himself; justice and injustice would be equally unknown among mankind' (ibid.).

Interestingly, Marx also uses part of this argument in the *Critique of the Gotha Programme*. Needless to say, he did not include the aspect of mutual affection, but the aspect of material abundance is clearly seen as the basis for the withering away of justice. This line of argument played a most important role in the aftermath of the Russian Revolution, where it was supposed to explain why a country like Russia with so little material wealth could not do away with the state bureaucracy, for example. Trotsky used this argument, saying that state and money would remain necessary as long as the material basis (i.e. more or less abundance) did not allow their withering away (Trotsky 1971: 56 ff.). But one should not overestimate the passage from the *Critique of the Gotha Programme*, for Marx was aware that people were different, that even personal antagonisms might survive capitalism (cf. 1859 *Preface*) and thus the conditions of justice might not disappear in communism (see also s. 5.5.3.).

5.3. Habermas: Marx between Kant, Fichte, and Hegel

Habermas emphasizes the double influence of Kant and Hegel on Marx's concept of nature. According to him, the fact that first nature cannot be completely transformed into second nature thwarts the Hegelian component in Marx's model. Instead, argues Habermas, something like the Kantian *Ding an sich* re-emerges here.

The materialist concept of synthesis [through social labour] thus retains from Kant the fixed framework within which the subject forms a substance that it encounters. This framework is established once and for all through the equipment of transcendental consciousness or of the human species as a species of tool-making animals. On the other hand, in distinction from Kant, Marx assumes empirically mediated rules of

synthesis that are objectified as productive forces and historically transform the subjects' relation to their natural environment. (Habermas 1971a: 35)

Habermas holds that Marx tried to overcome this theoretical dilemma by means of Fichte's philosophy. In so doing, Marx limits Fichte's absolute ego to mankind, which is a product of natural evolution and at each stage in its history is determined by the productive forces available to it. This can be stated in Fichte's terms where ego confronts its non-ego. As Habermas puts it, 'this interpretation given by Fichte with stubborn logic to Kant's pure apperception sheds light on the identity of socially laboring subjects as it is conceived by materialism. As an identical ego they find themselves confronting an environment that obtains its identity in labor processes; this environment is not ego' (Habermas 1971a: 39). Habermas rightly emphasizes that Marx is congenial to Fichte's insistence (against Kant) that the unity of consciousness is achieved only by an act of self-consciousness: it is a product of activity (see *ibid.* 40). Marx's stress on the active element in man's relationship to nature here parallels his judgement of Feuerbach. Having appreciated Feuerbach's philosophy in the early 1840s, Marx in 1845 reassures himself of the importance of the active element, which was developed by idealism. As he wrote in the first thesis on Feuerbach: 'The chief defect of all previous materialism (that of Feuerbach included) is that things [*Gegenstand*], reality, sensuousness are conceived only in the form of the object, or of contemplation, but not as sensuous human activity, practice, not subjectively. Hence, in contradistinction to materialism, the active side was set forth abstractly by idealism—which, of course, does not know real, sensuous activity as such' (CW v. 2). According to Habermas, Marx restates with Fichte Hegel's critique on Kant:

Marx restricts Fichte's absolute ego to the contingent human species. Its act of self-generation, the activity in which it constitutes itself, is thus absolute only in relation to historical formations of the ego and the non-ego, to societal subjects and their material environment. Production is conditioned on both sides by 'natural presuppositions' [nature and human labour]. (Habermas 1971a: 40)

But, Habermas continues, Marx's approach does not allow for a critical self-reflection of the productive subject, because Marx

limits production or *praxis* to labour (see *ibid.* 42). Habermas claims that there is a discrepancy between Marx's social theory and his philosophical self-understanding. In his social theory he was aware of both instrumental and communicative action, where the first consists of transforming nature, the second is embedded in cultural traditions and is exercised via symbolically mediated interaction. However, so goes Habermas's charge, Marx did not translate this insight into his philosophical framework. 'Taken by itself, scientific-technical progress does not yet lead to a reflexive comprehension of the traditional, "natural" operation of the social life process in such a way that self-conscious control could result' (*ibid.* 51).

5.3.1. *Labour and interaction*

Habermas's theoretical interest is thus in the first place to provide some thoughts on the philosophical-epistemological level. He does not think that Marx's concept of labour can fulfil this task. Instead, he introduces a distinction between two types of action: instrumental, nature-transforming action (which is characterized by means-ends relationships) on the one hand, and communicative action on the other, thereby taking up the distinction made by Aristotle (and further developed by Hannah Arendt) between *praxis* and *poiesis*. He characterizes the first type of action as typical of social systems, the second as typical of the life world. Instrumental action therefore not only refers to the transformation of nature, but also to the operation of social systems. I doubt that this distinction can help us tackle the ecological problematic. One reason for my scepticism is this: even granted that the institutional conditions for human emancipation do exist, there might still be something which escapes Habermas's framework but which is contained in that of Marx, above all in his analysis of machinery in the *Grundrisse* and the *Manuscripts 1861–3*. In other words, Habermas suggests that we could separate a conscious control of social life production from the process of material production: 'Marx very precisely distinguishes the self-conscious control of the social life process by the combined producers from an automatic regulation of the process of production that has become independent of these individuals. In the former case the workers relate to each other

as combining with each other of their own accord. In the latter they are merely combined' (Habermas 1971a: 51).

But this 'automatic regulation of the process of production' may constrain the 'self-conscious control' for ever. Communism in the strong sense ('human society') would thus be impossible. Habermas himself is aware that the development of productive forces leads to an increasing embodiment of knowledge in machines (ibid. 55 ('auf die Ebene von Maschinen abgebildet wird', Habermas 1968: 76)) which has its limiting value in the 'organisation of society itself as an automaton' (Habermas 1971a: 55). But if this is true, then Habermas's distinction between instrumental and communicative action becomes less important. For what can the 'self-reflection' (which is embedded in the latter type of action) achieve? According to Habermas, it can achieve abolition of ideological delusion (*Verblendung*) and class rule. But perhaps a still more urgent problem has been thereby neglected: the existence of a productive automaton which remains even after the fall of bourgeois order as an 'animated monster'. Communism could only mean the establishment of a classless society which is, however, still a society in which 'superior powers' are generated and reproduced systematically. Habermas does not seem to realize that Marx's 'ingenious combination of Kant and Fichte' (ibid.) is not doomed to fail because his model offers no place for critical self-reflection, but that on Marx's own account we have to reckon with the possibility that first nature can be transformed into second nature (under industrial conditions) only by paying the price of technological alienation. In other words, growth in productive forces leads to an increase in artefacts, *vis-à-vis* which the producers are only 'combined', not combining. As Marx noted in the *Grundrisse*:

The combination of this labour appears just as subservient to and led by an alien will and an alien intelligence—having its animating unity elsewhere— as its material unity appears subordinate to the objective unity of the machinery, of fixed capital, which, as *animated monster*, objectifies the scientific idea, and is in fact the coordinator, does not in any way relate to the individual worker as his instrument; but rather he himself exists as an animated individual punctuation mark, as its living isolated accessory. (*Grundrisse* 470)⁹

⁹ As I have shown in ch. 3, Marx's final analysis in *Capital* differs from this outline.

Now, if this trend cannot be reversed under communism, the 'true human society' will remain Utopia for ever. Habermas, although citing the same passage, does not pay attention to this question. He remains blind to the problem which technology poses to modern societies, since he thinks neither that technology can be brought back into the life world of the individuals nor that another type of technology can be imagined. He seems to assume that in order to make the producers the beneficiaries of a growth in productive forces,¹⁰ the establishing of a society in which the ideal speech situation is institutionalized would be necessary and sufficient. My argument against this is that not even such a society would have the means for controlling the unbounded 'animated monster'. As before, the producers would be the combined and not the combining. When they are stepping aside from the production process and engaging in discursive activities, they will eventually realize that their way of transforming nature must be changed; and is precisely here that Habermas's model does not show how the two can be brought together, unless he can show how the communicative action influences the instrumental one.

There is a certain ambivalence in Habermas (with respect to technical progress) which comes out in his 'early' critique of Marcuse. Here Habermas seems to immunize technical development against criticism: 'The idea of a New Science will not stand up to logical scrutiny any more than that of a New Technology . . . For this function, as for scientific-technical progress in general, there is no more "humane substitute"' (Habermas 1971b: 88). But here Habermas confuses technical and scientific development, partly identifying science with technology. The reason for this is his immaterial definition of productive forces, as we saw in Chapter 4. To avoid a possible misunderstanding here, I should say that I agree that in industrially developed societies there can be no functional alternative to science; but there can be *other technologies* (whilst it is difficult to imagine *another science*). This is the result of my analysis of social systems in Chapter 3 and 4, where I argued that technology is no social system. It follows that technology is open to social

¹⁰ Habermas rightly sees that growth in productive forces and the conditions of the good life are not identical, the former can 'at best serve' the latter, see Habermas 1971b: 119.

determination, its autonomy only an apparent one. The concrete shape of existing technologies is the result of conflicts and negotiations between social systems.

Habermas presents a somewhat different approach in the article 'Technology and Science as Ideology' which was written three years earlier. Here he acknowledges that 'this thesis of the autonomous character of technical development is not correct' (Habermas 1971a: 59). He rightly sees that 'the pace and the direction of technical development today depend to a great extent on public investments' (ibid.). Moreover, he says that technology is coupled with economy, science, and politics (ibid.). But even on the basis of this approach he stops short of considering the topic of changing existing technologies when he writes that 'through the unplanned sociocultural consequences of technological progress, the human species has challenged itself to learn not merely to affect its social destiny, but to control it' (ibid. 61). This is to say 'the social potential constituted by technical knowledge and ability [is brought] into a defined and controlled relation to our practical knowledge and will' (ibid.). He sees the main obstacle to this in 'social interests that arise naturally [*naturwüchsig*] out of the compulsion of the reproduction of social life without being reflected upon and confronted with the declared political self-understanding of social groups' (ibid. 60, amended translation¹¹). This is definitely not a mere restating of the orthodox Marxist position that it is only capitalist class rule which needs to be abolished; even a 'classless' industrial society would probably (to a certain extent) face these problems. But Habermas fails to show how the communicative type of action can change the course of technological development since here he thinks that it should be changed. Habermas himself poses the question in the following way: '[H]ow can the relation between technical progress and the social life-world, which today is still organized in a natural way, be reflected upon and brought under the control of rational discussion?' (ibid. 53, amended translation). Habermas's answer points to the liberating potential of an undistorted political discussion. Such a discussion is prohibited by domination (*Herrschaft*), by interests which are not subject to public justification (see ibid. 61). I doubt that such

¹¹ I use the term 'natural' to render the German '*naturwüchsig*', as is done throughout this work.

a diagnosis and therapy are sufficient for the problem at stake. Habermas's somewhat imprecise use of the notion of 'domination' is obscuring rather than illuminating here. For what is meant by this notion? Obviously it is to denote the interests of social systems *vis-à-vis* the life world, or, as he later says, the spill-over of systemic imperatives to the life world. However, these social systems operate according to different systems-codes; I find it difficult to fuse them together under the general heading *Herrschaft*. I would maintain that it is more illuminating to investigate the different mechanisms of the subsystems of society (i.e. also their conflicts!) in order to bring out both the dangers of some modern technologies and the possibilities of solving them (for an attempt to do so, see Luhmann 1989c).

To summarize: Habermas's framework seems to imply too rigid a distinction between different types of action, such that the communicative element is excluded from nature-transforming activities. Ironically, he himself has to reintroduce the communicative element to enable social reflexivity. This reintroduction is necessary for Habermas, since he is aware that a liberated society has to become self-reflexive not only in its communicative sphere, but also in its technical-instrumental sphere. But is, then, the separation between instrumental and communicative action of great help for the understanding of ecological problems?

5.4. Messianic Marxism

In this section, I set out to examine two writers who present an extraordinarily unorthodox Marxism: Ernst Bloch and Walter Benjamin. Both writers are most interesting in that they already focused on the problem of modern societies' relationship with nature some forty years ago. I shall claim that they are able to arrive at a position which is peculiarly aware of ecological problems on the basis of their metaphysical orientation. However, as will become clear, they cannot be put on a par with defenders of an ecocentric world-view.

5.4.1. Ernst Bloch: Marxism of technology

It is a merit of Bloch's analysis that he addresses the problem of science and technology for communist society in a detailed

way. In his book *Das Prinzip Hoffnung*, written during World War II and published in the 1950s, he discusses the question of technology above all in the chapter 'Will and Nature, Technological Utopias'. He praises bourgeois technology for having achieved some degree of progress, especially in constructing what he calls 'de-organicist' technology (*entorganisierende Technik*). This term is to denote the fact that modern technology cannot be understood any longer as a simple extension or replacement of the body (tool-arm; saw-teeth; eye-lens; etc.) but must be conceived as something completely new: 'And the more technology loses the final traces of its rootedness, or rather the more it gains new rootedness wherever it wants to, in the synthetic production of raw materials, in the radiation industry and whatever else in magnificent hubris: the more intimately and centrally the mediation with the interpolated system of nature must develop' (Bloch 1986: 671). This 'de-organicist' technology makes possible a more intimate mediation with nature.

But at the same time, he charges bourgeois technology with being too abstract, with pressing forms on to natural contents without understanding them: 'Thus it becomes evident again and again that our technology up to now stands in nature like an army of occupation in enemy territory, and it knows nothing of the interior of the country, the fact of the matter is transcendent to it' (ibid. 696).¹² In this respect, bourgeois technology is similar to capitalist economy: both produce accidents. Nevertheless, bourgeois technology is more reliable than its economy: 'Certainly bourgeois technology, by virtue of its elective affinity with natural mechanisms, is considerably more sound than the capitalist-abstract economic system, even non-Euclidean acts of boldness are not denied to it, they stand out remarkably, as we have seen' (ibid. 695). Bloch aims at a more intimate transformation of nature following Bacon: 'The control of nature [*Naturbeherrschung*] serves in Bacon the establishment of a "regnum

¹² The metaphor of the conqueror was also used by Engels—see *CW* xxv. 461. Interestingly, Engels says the following with respect to the Italian Alps: 'when the Italians of the Alps used up the pine forests on the southern slopes, so carefully cherished on the northern slopes, they had no inkling that by doing so they were cutting at the roots of the dairy industry in their region: they had still less inkling that they were depriving their mountain springs of water for the greater part of the year, and making it possible for them to pour still more furious torrents on the plains during the rainy seasons' (*CW* xxv. 461).

hominis" . . . Bacon's great maxim: "Natura parendo vincitur", nature is conquered by obedience, remained active, but it was crossed by the interest of an "exploitation" of nature, and thus by an interest which has nothing more to do with the natura naturans which Bacon still knows and singles out as the "causa causarum", let alone being allied to it' (ibid. 657).

Against this Bloch holds that we have to construct new technologies which achieve a more intimate relationship with nature; a relationship which is totally different from the attitude of a conqueror who stands in the land of the enemy, pushing around the recalcitrant elements. Bloch accepts that it is mankind's project to gain fuller mastery over nature. However, he does not agree that 'exploitation of nature' should be part of that project. There are two terminological questions which arise here. The first is the question whether nature can be exploited, if it makes sense to speak of an 'exploitation of nature' in the strict sense.¹³ When talking about exploitation, we usually have individuals in mind who, according to some moral standards, can be said to exploit other individuals. Obviously, this does not apply to man's relationship to nature, unless one is prepared to adopt an approach which attributes rights to nature (see the discussion in ch. 2). In a weaker sense, however, we all speak of exploitation of natural *resources*, a process which Bloch does not oppose as such. 'Marxism of technology, once it has been well thought-out, is no philanthropy for maltreated metals, but rather the end of the naive application of the standpoint of the exploiter and animal tamer to nature' (ibid. 695). The second, and more important, question seems to be that Bloch also uses the term in another sense: he wants to express the fact that people will not succeed in mastering nature if they 'exploit' it, that is, if they are not able to transform it according to some inherent laws or structures of the material elements. This means that they will not succeed in transforming it if they do not understand the laws and mechanisms involved. As I showed at the beginning of Chapter 2, quoting Bodei, ancient thought conceived of technical solutions as solutions directed *against* nature; it was only with modern writers that they were understood as *in accordance* with natural laws—see Bodei 1983.

¹³ Note that Bloch himself put 'exploitation' in quotation marks.

Bloch's position is thus a position within modernity, accepting central claims of Enlightenment philosophy. He shares the belief that mankind can prosper in transforming nature; he does not reject the development of science and technology; on the contrary, he holds that only more developed technologies will contribute to mankind's prospering. These new technologies, however, need to be based on more profound insights into nature—something which seems inhibited by present capitalist relations. In so doing, he implicitly tries to defend the 1859 *Preface*, although it is not clear whether he charges capitalism with insufficient development or insufficient use of new productive forces.¹⁴ But at the same time, Bloch is aware that not every increase in productive forces contributes to social progress when he says that all rejoicing about great technical progress is in vain if it forgets that technical progress can be accompanied by social regress (see Bloch 1986: 696).

My interpretation of Bloch is very charitable compared with that of Alfred Schmidt, for example. Let me therefore briefly sum up Schmidt's criticisms. He charges Bloch (1) with overestimating the possibility of unifying subject and object. Bloch aims at a 'mystical nature-subject' (*Natursubjekt*) which has not yet¹⁵ revealed itself; (2) with being obscure about the 'openness' (*Unabgeschlossenheit*) and 'latency' of nature. I address the two points in turn.

1. Schmidt is right when he insists that mankind's purposes will always remain alien to nature—also in socialism (see Schmidt 1971: 167)—and that mankind *has* to outwit nature. In this respect Bloch's terminology is indeed misleading (or self-contradictory). Consider the following passage by Bloch: 'In place of the technologist as a mere outwiter or exploiter there stands in concrete terms the subject socially mediated with itself, which increasingly mediates itself with the problem of the natural subject' (Bloch 1986: 674). This may sound strange and confused, but one may interpret it that Bloch wants to stress the possible role of nature as co-producer, a role which can be set forth only on the basis of a deeper understanding of nature. But then, to repeat, he gets self-contradictory, since the Baconian

¹⁴ See Elster 1985: 259 for a distinction.

¹⁵ This is the crucial notion for Bloch: the 'not-yet-character' of all that exists.

approach also implies an *Überlister*-technology. Moreover, the co-operative role of nature would also put man in the role of exploiter or outwiter (*Überlister*): either humans appropriate what nature freely produces, or they combine natural processes in a way beneficial to them: in the latter case, the 'cunning of reason' (= *überlisten*) is at work. Of course, I agree that there are mystical and religious elements in Bloch's concept of nature; but, nevertheless, I think that the interpretation which I gave above is a legitimate one. To put it in another way, Bloch's metaphysical beliefs may have made him sensitive to a problem which does not so much interest traditional Marxists. We could say, then, that Bloch's analysis was non-Marxist in its motivation but Marxist in its method. It is admitted that there is a 'metaphysical surplus' which does not square with Marxian thought (see also Hudson 1982).

2. Schmidt's doubts about nature's 'latency' seem to be even less justified. Here it is Bloch, rather, who is in greater accord with the natural sciences. As we know from Darwinism, nature is an essentially unfinished and open process. Curiously, Schmidt thinks that higher beings than humans cannot emerge (cf. Schmidt 1971: 162). This seems to me an exaggerated anthropocentrism, one which conceives mankind as the centre of the universe. Evolution is a blind, and thus open, process, the stages of which are not predetermined.

5.4.2. Walter Benjamin: the resurrection of past generations

In Chapters 3 and 4, I presented and discussed some evolutionary approaches to social history. It was argued that, on a materialist conception, the new can only emerge as a recombination of the existing. Such a view certainly may be challenged from several positions. One of them is a position which expects the *new* as *the totally different* from the present. Walter Benjamin, in his *Geschichtsphilosophische Thesen*, put forward such an argument.

Criticizing the notion of progress held by the German Social Democratic party, he noted that this was problematic in that it conceived of progress (1) as progress of the human species, (2) as unlimited (perfectibility), and (3) as inevitable (see Benjamin 1974: 700).¹⁶ But basic to these three problematic notions is a

¹⁶ Note that his charge does not fit an *evolutionary* approach, as presented in chs. 3 and 4.

concept of time as empty and homogeneous.¹⁷ Against such a concept Benjamin contends that history is a *construction* which is located in our time, not in empty and homogeneous time: 'History is the subject of a construction whose site is not homogeneous, empty time, but time filled by the presence of the now [*Jetztzeit*]' (Benjamin 1973: 263, amended translation). This fact allows us to cite past events, just as fashion cites past clothes; the French Revolution cited ancient Rome and understood itself as a renewal of it.

The French revolution viewed itself as Rome reincarnate. It evoked ancient Rome the way fashion evokes costumes of the past. Fashion has a flair for the topical, no matter where it stirs in the thickets of long ago; it's a tiger's leap into the past. This jump, however, takes place in an arena where the ruling class gives the commands. The same leap in the open air of history is the dialectical one, which is how Marx understood the revolution. (ibid.)

Central to Benjamin's argument is the notion of 'blasting out' (*heraussprengen*) these past events from the continuum of history. This metaphor corresponds to a second one which refers to the picture we have of these past events and which is available to us only in moments of danger. Benjamin coins the term 'flashing' (*aufblitzen*) for it: 'The past can be seized only as an image which flashes up at the instant when it can be recognised and is never seen again' (ibid. 257). With these two basic concepts, we can understand Benjamin's different conception of social change. There is no stream of progress in which the Social Democratic Party and the working class can swim, but there are unique historical opportunities where a picture becomes available to the historical subject and this can be reactivated at other such moments. 'Historical materialism wishes to retain that image of the past which unexpectedly appears to the historical subject at a moment of danger' (ibid., amended translation). This last technique refers to the method of the materialist historian; for the fighting class the cognitive *flashing* is combined with practil *blasting out* (*heraussprengen*).¹⁸ Benjamin's preoccupa-

¹⁷ Lukács in his seminal *Geschichte und Klassenbewußtsein* (1923) noted that modern capitalism transforms time into a pure quantitative category—see Lukács 1971: 179–80.

¹⁸ Note that both metaphors are metaphors from war; Benjamin wrote this text in 1942.

tion with the phlegmatic politics of the Social Democrats leads to an overreaction. He frankly endorses an extreme subjectivism: for him, there seem to be no historical laws or mechanisms but only the one of the grasping of unique historical *opportunities*. This 'tiger's leap' into the past corresponds to his claim of an increasing acceleration of history, as he noted in Thesis XVIII:

'In relation to the history of organic life on earth' writes a modern biologist, 'the paltry fifty millennia of homo sapiens constitute something like two seconds at the close of a twenty-four-hour day. On this scale, the history of civilized mankind would fill one-fifth of the last second of the last hour.' The present, which, as a model of Messianic time, comprises the entire history of mankind in an enormous abridgement, coincides exactly with the stature which the history of mankind has in the universe (ibid. 265)

Although Benjamin calls this approach the true approach of the historical materialist, it is, rather, idealist. The 'totally different' is not something which has not yet been there, but, rather, something which did indeed exist a long time ago. Proletarian revolution therefore consists in bringing back a lost state of history. Revolution, for Benjamin, is *redemption*, revenge for the injustice to former generations.

Not man or men but the struggling, oppressed class itself is the depository of historical knowledge. In Marx it appears as the enslaved class, as the avenger that completes the task of liberation in the name of generations of the downtrodden. This conviction . . . has always been objectionable to Social Democrats . . . Social Democracy thought fit to assign to the working class the role of the redeemer of future generations, in this way cutting the sinews of its greatest strength. This training made the working class forget both its hatred and its spirit of sacrifice, for both are nourished by the image of enslaved ancestors rather than that of liberated grandchildren. (ibid. 262)

Although Benjamin is not concerned with future generations,¹⁹ he is able to work out a sensitive position in relation to nature.

¹⁹ In Annex B to the *Theses* Benjamin makes clear that his approach is informed by Jewish religion: 'We know that the Jews were prohibited from investigating the future. The Torah and the prayers instruct them in remembrance, however. This stripped the future of its magic, to which all those succumb who turn to the soothsayers for enlightenment. This does not imply, however, that for the Jews the future turned into homogeneous, empty time. For

However, this sensibility comes from his religious background. As he noted in *Einbahnstraße*, human beings have to revere nature, since they depend on nature and are not able to give it anything. Thus, whenever they receive something from nature, they ought to be grateful.

The earliest customs of peoples seem to send us a warning that in accepting what we receive so abundantly from nature we should guard against a gesture of avarice. For we are able to make Mother Earth no gift of our own. It is therefore fitting to show respect in taking, by returning a part of all we receive before laying hands on our share . . . An Athenian custom forbade the picking up of crumbs at the table, since they belonged to the heroes. If society has so degenerated through necessity and greed that it can now receive the gifts of nature only rapaciously, that it snatches the fruit unripe from the trees in order to sell it most profitably, and is compelled to empty each dish in its determination to have enough, the earth will be impoverished and the land yield bad harvests. (Benjamin 1986: 76)

According to Benjamin, a society without exploitation might be able to give nature something back, even to 'improve' it: 'Once this exploitation has stopped, labour too will lose its nature-exploiting character . . . Such labour which is animated by play does not aim at the production of values but at an *improved nature*' (Benjamin 1982: 456, my translation, my emphasis).

Now, one might say that Benjamin's approach is forceful and persuasive but has the disadvantage of being based solely on an ethical dimension: gratitude towards nature.²⁰ Of course, he wants to abolish the social conditions which inhibit such an 'alien' relationship to nature, but one might ask if this can be a realistic perspective for industrial societies. Let me thus turn to Benjamin's 'technical utopia'. Benjamin, unlike some 'green' fundamentalists, does not reject technological development. When proposing Fourier's ideal of labour (i.e. play), Benjamin is

every second of time was the strait gate through which the Messiah might enter' (Benjamin 1973: 266). But see Adorno 1977: 619 for a view which mentions Benjamin's concern for future generations.

²⁰ Interestingly, Bloch juxtaposes Schiller's and Goethe's concepts of nature; according to Bloch, the former wants to dominate nature ('Beneficent is the fire's might, if man controls and guards it right'), the latter is grateful to nature: 'Sublime spirit, you gave me / gave me all for which I asked / You did not turn in vain / your countenance to me within the fire' (Faust, part I, ff. 3217–20, as quoted in Bloch 1986: 670).

aware that labour can become play only on the basis of the most developed productive forces: 'The unfolding and blossoming in playing presupposes highly developed productive forces which are available to mankind only today. However, they are provided only in the opposite sense of their potential: for the case of emergency' (ibid., my translation). Likewise, this 'liberated labour' is to 'improve' nature by technical means. Benjamin again cites with approval Fourier's *Phalanstères*: 'According to Fourier, good social labour should bear the consequence that four moons would illuminate the earthly night, that ice would retreat from the poles, that sea water would no longer taste salty, and that wild animals would enter the service of humanity. All this illustrates a type of labour which, far from exploiting nature, would set free the creations which are slumbering in its womb' (Benjamin 1974: 699, my translation).²¹ Perhaps it should be said that nowadays we may have the possibility of creating such animals with the help of genetic engineering (leaving open the question whether this is 'liberated work'): but who would be delighted? Similarly, the poles may be melting in the near future, but with quite disastrous consequences.

Furthermore, Benjamin hopes that mankind will make true cosmic experiences—which he thinks indispensable—with the help of technology. The ancient relationship towards the cosmos was mediated by the experience of ecstasy (*Rausch*), while we moderns have technical possibilities at hand. These possibilities are extrapolated from war technologies which, of course, have been used only for destructive purposes. The result was a 'river of blood' (see Benjamin 1986: 93). But at the same time Benjamin is fascinated by these new technologies: 'High-frequency currents coursed through the landscape, new constellations rose in the sky, aerial space and ocean depths thundered with propellers . . .' (ibid.).²² However, the fascination is immediately broken when Benjamin adds the following to his enumeration: '. . . and

²¹ Note the similarity to Bloch, who uses the notion of nature's co-productivity, its 'latency'. See also the similarity to Bloch's technological Utopia: 'Just as the chain reactions on the sun bring us heat, light and life, so atomic energy . . . creates fertile land out of the desert, and spring out of ice. A few hundred pounds of uranium and thorium would be enough to make the Sahara and Northern Canada, Greenland and the Antarctic into the Riviera' (Bloch 1986: 664).

²² Note the parallel to writers like Ernst Jünger or the Italian futurists; see Hinz 1985 for the latter.

everywhere sacrificial shafts were dug in Mother Earth' (Benjamin 1986: 93). The ruling class's yearning for profit had changed the bride's bed into a river of blood (cf. *ibid.*). This sexual metaphor can be seen to conceive of the possibilities of technology in the same way as Bloch: as in principle leading to a more intimate relationship with nature. Again, like Bloch, these possibilities are not put into practice as a result of capitalist relations.

The mastery of nature, so the imperialists teach, is the purpose of all technology. But who would trust a cane wielder who proclaimed the mastery of children by adults to be the purpose of education? Is not education above all the indispensable ordering of the relationship between generations and therefore mastery, if we are to use this term, of that relationship and not of children? And likewise technology is not the mastery of nature but of the relation between nature and man. (*ibid.*)

With this formulation, Benjamin arrives at an extraordinary insight: he captures a central problem of modern societies in an ingenious fashion. He concentrates on the results of relations of domination, stressing the need for reflexivity. We gain nothing, he says, if we insist on the right to dominate nature (assuming we wish to use that term). Instead, he continues, we should be able to control ('dominate') this *relation*. This formulation is congenial to Marx's project in that it stresses both the need to transform nature with the help of technologies and the need to evaluate these transformations. Domination of nature thus becomes a reflexive concept.²³

5.5. Conscious control and central planning

5.5.1. Marx, Vico, and social complexity

Marx derived part of his historical optimism from Vico and the tradition which followed him (cf. Berlin 1976: 94, 137). Indeed, if Vico's claim were true, there would be a powerful reason to share Marx's optimism. As Marx indicated in a footnote in *Capital* I, he agreed with Vico that man can understand the world which is his own product much better than the world of

²³ See also Luhmann (1984a: 644–5), who defines social rationality as the system's awareness of the reflexivity of its own operations on its environment.

nature (which is, according to Vico, the product of God). Marx says:

Does not the history of the productive organs of man, of organs that are the material basis of all social organisation, deserve equal attention? And would not such a history be easier to compile, since, as Vico says, human history differs from natural history in this, that we have made the former, but not the latter? (*Capital* I. 352)

It is noteworthy that many commentators have not noticed the important implications which follow from this claim. Marx is often charged with having overlooked the fact that nature will never be completely transformed. Alfred Schmidt also bases his criticism of Bloch on this line of argument: 'Despite its increasing mediation, nature never becomes something completely "made" by us . . . This point expresses the most fundamental mark of distinction between the idealist and the materialist dialectic: even in a truly human world there is no full reconciliation of Subject and Object. This is what frustrates Bloch's hope for a philosophy of identity' (Schmidt 1971: 158). But Schmidt neglects the more basic problem: (even granted that nature and society could be reconciled) what if human creations still cannot be conceived as human creations and thus cannot be fully understood?²⁴ In other words, what if the social sphere loses its privileged cognitive status?

After all, it is only natural for us to doubt such a privileged status for the social sciences: did not the positivists charge the humanities with indulging in unscientific enterprises and with pretending to have gained knowledge about non-natural things? The motivation for this attack came from their experience of self-proclaimed human sciences, such as Marxism and psychoanalysis, on the background of a fundamental crisis of the exact sciences such as physics and mathematics. How strong this positivist influence was (and still is), we can see if we look at commonsense opinions regarding this problem. It is a widespread view that the natural sciences are able to know more about nature than the social sciences about society. It would be interesting to

²⁴ Marx faces this problem when he discusses a possible 'deviation' of technologies from human abilities. However, he assumes a strong functional mechanism to be at work here which links human abilities to existing productive forces. See *CW* v. 87–8 and *Capital* I. 488.

examine how different epochs (and different writers) have seen this cognitive problem—a task which lies outside the framework of this study. What I want to do here is to formulate some doubts regarding Marx's privileging of 'the social' with respect to cognition. I do this by looking at some results of contemporary social research.

Todd La Porte, in his seminal *Organized Social Complexity*, observes that

[O]ne particularly striking aspect of modern political and social development has been the capacity of men to construct social systems encompassing more and more groups. Our lives are bounded by agencies, organizations, combines, coalitions, and associations: networks of hundreds of connected groups and persons . . . One consequence of these increases in group connections . . . has been the tightening of organizational dependencies affecting social dynamics and political movements. Another has been a rapid increase in the number of people and agencies affecting the day-to-day experiences of individuals. Closely related to this increase has been one in the number of surprises we encounter. They are generally disturbing surprises, caused by the interruption or frustration of our expectation by some hitherto unrecognized dependency. (La Porte 1975: 3)

La Porte calls this a condition of social complexity—to be more precise, of *organized* social complexity. 'Systems that are characterized by organized complexity . . . are those in which there is at least a moderate number of variables or parts related to each other in organic or interdependent ways' (ibid. 5). The most obvious empirical referents are 'social groups with conscious purposes, such as formal organizations or informal, but cohesive, groups and associations' (ibid. 6). It is important that these systems are self-conscious in order that their interaction can count as *organized*. La Porte then provides a working definition of organized social complexity: 'The degree of complexity of organized social systems (Q) is a function of the number of system components (C_i), the relative differentiation or variety of these components (D_i), and the degree of interdependence among these components (I_k). Then, by definition, the greater C_i , D_i , and I_k , the greater the complexity of the organized system (Q)' (ibid.). La Porte concludes: 'If it is true that the texture of life and its social institutions has become increasingly complex and can be expected to continue so, the implications for social

theory, for political science, for the techniques of inquiry, and—perhaps most important—for public policy are enormous' (ibid. 18).

Now this is obviously an argument which presents a strong challenge to the Vico–Marx position.²⁵ For if these are pervasive traits of modern societies, Marx's hope for an abolition of fetishism, for a full reappropriation of man's objectifications, for a 'reconciliation', is doomed. It is not doomed because of an 'indissoluble' rest of nature, which cannot be transformed, but for the opposite reason: even if mankind succeeds very well in transforming nature we have to take into account the paradoxical result that it now suffers from *social* opacity. The process which leads to such a result is the development of the productive forces, which have grown not only in efficiency but also in size: as Marx himself was aware, the relation between individual (craft worker) and technology (his craft instrument on which he played like a virtuoso) was reversed with the advent of modern industry. To run certain technologies, it is indispensable to have a whole network of social institutions. Immediately connected to this diagnosis is the question of planning, or of 'socialsteering'. I lack not only space but also competence to discuss the different judgements on the prospects of planning in complex societies.²⁶ I only want to bring out a theoretical dilemma (which seems to be also a historical one) which Marx did not confront.

Recall his distinction between ancient societies and communism. In ancient societies people were dependent on nature to a large degree. Their 'mastery' of nature is on a low level. To this corresponds a mystical world-view: nature is essentially an *opaque* thing for human beings, whereas social relations in ancient societies are transparent. Communist societies, on the other hand, have succeeded in transforming nature into second nature, resulting in a (nearly) transparent nature and a transparent

²⁵ The challenge becomes even stronger if we assume that ecological problems arise out of an interplay between social and natural processes, both (at times) poorly understood—not to speak of their complex interaction. How little we know in this respect can be grasped from the discussion which followed the publication of a number of 'world-models' (Club of Rome and others) which tried to connect several factors in an obviously unsatisfying way.

²⁶ See the contributions of La Porte (1975); Mayntz (1986); Scharpf (1989); Luhmann (1989a); Teubner (1989a); Willke (1991); Krohn and Küppers (1990); Bühl (1989).

society. In between ancient and communist societies lie societies which, to differing degrees, exhibit natural and social opacity; but the gross course of history seems to follow a road on which natural opacity decreases and social opacity increases—up to a point (capitalism) where, according to Marx, the social realm is most opaque, but the possibilities of breaking it up increase proportionally. However, this mechanism is a rather speculative one. Marx excludes the possibility that social opacity cannot be blasted away, but perhaps at most reduced. The growth of productive forces has led to a decrease in natural opacity but also to an increase in social opacity. Whereas Marx saw this opacity as a result of false reality which could be transformed into a true reality, some contemporary sociologists are more sceptical. They explain social opacity by social complexity which cannot be abolished. In other words, the 'inverted world' (Marx) presents an irreversible stage of social evolution. According to their approach, the evil has to be located more deeply than Marx locates it. If they are right, then Marx's assumption that with the abolition of capitalism fragmentation and alienation would also vanish must be regarded as obsolete.

5.5.2. Central planning¹

In section 5.1, I made the distinction between a weak and a strong notion of communism. The decisive difference has been identified in the existence of alienation and fetishism. However, according to Marx, alienation and fetishism have their social roots in privately producing units, i.e. under market conditions. The dichotomy market/plan thus becomes most important here. As we shall see, Marx was not very clear about the survival of markets in communism and the role of central planning. Take, first, his assertion in *Capital* that 'only products of different labour processes, carried on independently for the accounts of different private individuals, confront one another as commodities' (*Capital* i. 49, amended translation). This qualification enables Marx to claim that a socialist economy which has abolished exploitation, but continues to exchange products, is also free of commodity fetishism, since its products are not commodities. But this claim overlooks the fact that if different units of production (for example, workers' co-operatives) under

socialism exchange products with each other, these products assume the form of commodities since they are use-value and exchange-value at one and the same time. Marx offers only a verbal resistance to such a conclusion by insisting that the different units of production must be carried on by *private individuals* in order for their products to assume the form of commodities (which, rather than providing a solution, begs the question). The whole problem therefore seems to come down to the question of market and plan.

Before going into detail, a preliminary remark is in order. Up to now, I have quoted several passages from Marx where he speaks of 'conscious control' or a 'settled plan' which would be necessary for a communist society. I should like to stress that these notions are philosophical and abstract notions. We cannot, therefore, immediately derive from them an answer to the question whether Marx was in favour of central planning (in the sense of 'command economy') or not. And, what is more, he might even have opposed central planning if it came into opposition with the 'conscious control', that is, if the side-effects and irrationalities of central planning would have thwarted the full conscious self-control of mankind's fate. As I shall claim, Marx's theoretical framework requires both markets and plan. Marx needs markets for the transformation of concrete labour into abstract labour, and he needs the plan to establish the social character of labour from the outset. There is no way out of this dilemma.

As Michael Harrington observed, 'Marx is a major source of the contemporary confusion, not the least because he provides solid authority for contradictory positions' (Harrington 1989: 57). According to him, Marx regarded the Ten-Hours Law as nothing less than a 'modest Magna Charta', 'as the triumph of the political economy of the working class over the political economy of the middle class'. From this one can infer that in a 'socialist-tending society, markets would have an utterly different meaning than under capitalist laissez-faire'. But things are not so easy with Marx: 'Unfortunately, *Das Kapital* also provides solid reasons for arguing a contrary position: that socialism must totally dispense with markets. Small wonder that matters got confused' (ibid. 58).

Marx criticized Proudhon and the Ricardian socialists Bray

and Gray several times for their proposal to abolish money and replace it with certificates for labour time (see *CW* xxix. 320 ff.). Marx's main point of criticism is that their solution would be self-defeating, since it proposes that goods be produced, but not exchanged, as commodities (see Moore 1980: 73; see also Cohen 1978: 127–8). Marx never proposed to 'count any two hours of concrete labour as equivalent. This is the solution of Proudhon and Dühring, but not that of Marx' (Moore 1980: 73). Instead, claims Moore, Marx was looking for a mechanism to translate concrete labour into abstract labour, since he was constantly aware of every society's need to perform this transformation. Marx maintains that 'complicated labour . . . [is] labour of greater intensity and greater specific gravity . . . [which] resolves itself into simple labour put together; it is simple labour raised to a higher power, so that for example one day of skilled labour may equal three days of simple labour' (*CW* xxix. 273). In a letter to Kugelmann he writes, 'that this necessity of the distribution of social labour in definite proportions cannot possibly be done away with by a particular form of social production but can only change the mode of appearance, is self-evident' (*SW* ii. 419). And in *A Contribution to the Critique of Political Economy*, Marx explains:

To measure the exchange values of commodities by the labour time they contain, the different kinds of labour have to be reduced to uniform, homogeneous, simple labour, in short to labour of uniform quality, whose only difference, therefore, is quantity. This reduction appears to be an abstraction, but it is an abstraction which is made every day in the social process of production. The conversion of all commodities into labour time is no greater an abstraction, and is no less real, than the resolution of all organic bodies into air. (*CW* xxix. 272)

But how, then, translate and measure more complicated labour? Here Marx relies on the reality of bourgeois society which has already brought about the transformation of a great part of social labour into simple labour: 'The greater part of the labour performed in bourgeois society is simple labour as statistical data show' (*CW* xxix. 273). But what, then, about the smaller part of complicated labour? How is the reduction brought about? Marx's answer in this text is evasive when he says: 'The laws governing this reduction do not concern us here' (*CW* xxix. 273).

Eight years later, in the first volume of *Capital*, Marx conceives of labour performed under conditions of modern industry as nearly completely simple labour: 'Hence, in the place of hierarchy of specialised workmen that characterises manufacture, there steps, in the automatic factory, a tendency to equalise and reduce to one and the same level every kind of work that has to be done by the minders of the machines' (*Capital* i. 396; see also *MEGA* ii. iii. 1. 209). Finally, in the *Critique of the Gotha Programme*, Marx runs into a difficulty when he claims on the one hand that in the first stage of communism each should be rewarded according to her labour contribution, but, on the other hand, recognizes that labour is heterogeneous, that is, different workers perform different amounts of labour in a given time period (see *SW* iii. 18–19).

To turn to the other horn of the dilemma. Marx never tires of demanding that labour be directly part of the aggregate labour of society, that it acquire this social character not only *post festum*, through the market, but from the outset. This insistence derives from his insight that fetishism and alienation arise only in conditions under which the producers are separated from each other, where 'fragmentation has become the normal state of affairs' (*MEGA* ii. iii. 6. 2181), where products assume the form of value—in a word: in market economies. From this insight follows his proposal to abolish markets and to replace them with a central plan:

If we conceive society as being not capitalistic but communistic, there will be no money-capital at all in the first place, nor the disguises cloaking the transactions arising on account of it. The question then comes down to the need of society to calculate beforehand how much labour, means of production, and means of subsistence it can invest . . . In capitalist society however where social reason always asserts itself only *post festum* great disturbances may and must constantly occur. (*Capital* ii. 318–19)

Note that society is conceived here to calculate labour quanta. However, Marx does not tell us how this should be done. He only suggests that producers may now get paper certificates for their performed work:

In case of socialised production the money-capital is eliminated. Society distributes labour-power and means of production to the different

branches of production. The producers may, for all it matters, receive paper vouchers entitling them to withdraw from the social supplies of consumer goods a quantity corresponding to their labour time. These vouchers are not money. They do not circulate. (*Capital* ii. 362)

There are several problems with that solution. The first is that labour has been reduced to simple, homogeneous labour in order that it can be compared. However, this does not match with Marx's position that the character of labour under communism will definitely be different from that under capitalism, a point to which I come in a moment. Another difficulty is that Marx thinks that these vouchers would not circulate. But who would ensure this? Would it not be natural to assume that they get exchanged, that a market of labour vouchers would emerge?²⁷

To summarize the argument so far. In order to abolish fetishism, Marx needs to abolish labour markets; in order to calculate the ratios of concrete and abstract labour, he needs to retain markets.²⁸ My claim is that Marx employs the term 'conscious control' to cover two different principles of organizing the economy: market and plan. Note that market and plan are not *as such* incompatible; mixed economies or market socialism may be feasible social forms. In the *Civil War in France*, Marx in fact seems to combine markets and plan:

[Those] members of the ruling class who are intelligent enough to perceive the impossibility of continuing the present system—and they are many—have become the obtrusive and full-mouthed apostles of co-operative production. If co-operative production is not to remain a sham and snare; if it is to supersede the Capitalist system, if united co-operative societies are to regulate national production upon a common plan, thus taking it under their own control, and putting an end to the constant anarchy and periodical convulsions which are the fatality of Capitalist production—what else, gentlemen, would it be but Communism, 'possible' Communism? (*CW* xxii. 335; see also Moore who points out that the *Communist Manifesto* contains a model of market socialism which Marx was later to abandon: Moore 1980: 66–70):

²⁷ Note that Marx at this point takes up the proposal of the Ricardian socialists, and of Proudhon, to substitute money for such vouchers. The difference is that production is now socialized—Marx is therefore consistent in criticizing their proposal and in proposing something similar here. (But note how uncomfortable he feels: he says *meinetwegen* they may receive paper vouchers...)

²⁸ See Kosta, Meyer, and Weber (1973: 99 ff.), who report on attempts in the GDR to measure complicated labour without markets.

Social theory has developed the following concepts to distinguish between three forms of socialization. Whereas Oliver Williamson (1975) distinguishes only between two forms, markets and hierarchies, Luhmann (1984a: 522) distinguishes between competition, co-operation, and exchange; Elster (1985), following Polanyi, distinguishes between market, planning, and reciprocity. These distinctions are different, but also overlapping.²⁹ One could, for example, fuse them under the headings of market, state, and solidarity. And it seems that all modern societies employ all of the three mechanisms. A simple thought can illustrate this. Take first the plan: if it is not perfect (and who would assume it can be?), there will always emerge a market besides the plan—albeit a black market. Above we saw that it would be natural to assume the circulation of labour vouchers. Similarly, it would be absurd for a 'free' society simply to forbid markets. Likewise, if the market does not work perfectly (and who would assume it does?), state intervention will become necessary. Finally, solidarity seems always to operate in social relations, at least on the micro-level (interactions, families) but also on higher levels (agreements between firms, institutions, etc.).

If labour gets reduced to simple labour under capitalist conditions, will it retain this character in communism? Obviously not, if we look at Marx's own writings. I have already quoted the passage from *Capital* where Marx stresses the need for varied work which becomes realized first under capitalist relations. Certainly, one could say that varied work may be at the same time simple work—but Marx in *Capital* also stresses the need for an all-round education which is a clear sign that labour cannot be conceived as simple work. In my view, Marx did not change his basic position in respect of labour from the *Grundrisse* to *Capital*. But he has moved into a dilemma whose two aspects are the following: either he has a consistent position in favour of labour markets which transform complex into simple labour; but this solution entails the danger of fetishism and alienation. Or he has a consistent position in favour of planned labour allocation—in which case he has to assume that labour under communism has the same character as under capitalism.

²⁹ Further examples are Parsons and Shils 1951; Dahl and Lindblom 1953; Kaufmann, Majone, and Ostrom 1986.

5.5.3. *Social complexity and personal differences*

In this section, I briefly point to an apparent difficulty with Marx's concept of communism which has to do with the possible underestimation of (1) the importance of personal conflicts and (2) the importance of social functions. I address these two points in turn.

Marx repeatedly stated that individuals were different.³⁰ However, he seemed to believe that only under conditions of class societies, especially capitalism, would personal differences turn into conflicts. With the abolition of private property and classes, he argues, personal differences can be put to the benefit of all instead of turning into conflicts between individuals. In the *German Ideology*, Marx and Engels assert that 'with the abolition of the basis, private property, with the communistic regulation of production (and implicit in this, the abolition of the alien attitude [*Fremdheit*] of men to their own product), the power of the relation of supply and demand is dissolved into nothing, and men once more gain control of exchange and the way they behave to one another' (CW v. 48). In the *Communist Manifesto*, we read: 'In place of the old bourgeois society, with its classes and class antagonisms, we shall have an association, in which the free development of each is the condition for the free development of all' (CW vi. 506). In the *Comments on James Mill*, we read:

Let us suppose that we had carried out production as human beings. Each of us would have in two ways affirmed himself and the other person. (1) In my production I would have objectified my individuality, its specific character, and therefore enjoyed not only an individual manifestation of my life during the activity, but also when looking at the object I would have the individual pleasure of knowing my personality to be objective, visible to the senses and hence a power beyond all doubt. (2) In your enjoyment or use of my product I would have the direct enjoyment both of being conscious of having satisfied a human need by my work, that is, of having objectified man's essential nature, and of having thus created an object corresponding to another man's essential nature . . . I would have directly confirmed and realized my true nature, my human nature, my communal nature. Our products

³⁰ See 1859 *Preface, The Critique of the Gotha Programme*.

would be so many mirrors in which we saw reflected our essential nature. (CW iii. 227–8)

As far as this argument rests on the assumption of limitless material abundance it must be rejected on the grounds that Marx himself gave: there will never be a society with limitless material abundance. As far as the argument rests on the assumption that personal endowments and interests can be channelled via a division of labour to the benefit of all, it seems to presuppose an unrealistic notion of social harmony. As Elster pointed out, '[e]ven assuming people to be moved by altruism or a concern for the common good, they might not have a common conception of what that good is' (Elster 1985: 458). Marx could agree with such an account, arguing that this is characteristic of the first stage of communism, which is 'in every respect, economically, morally and intellectually, still stamped with the birth marks of the old society from whose womb it emerges' (SW iii. 23). And in the early *Paris Manuscripts*, Marx conceives of a 'crude communism' which may well correspond to the two stages in the *Gotha Programme*. Marx writes:

This type of communism—since it negates the personality of man in every sphere—is but the logical expression of private property, which is this negation. General envy constituting itself as a power is the disguise in which *greed* re-establishes and satisfies itself, only in another way. The thought of every piece of private property as such is at least turned against wealthier private property in the form of envy and urge to reduce things to a common level, so that this envy and urge even constitute the essence of competition. Crude communism is only the cumulation of this envy and of this levelling-down proceeding from the preconceived minimum. (CW iii. 295)³¹

Maihofer pointed out that for this reason law as a social function would be indispensable for communist society.³² Now this seems to contradict Marx's hope of a 'withering away of the state'. Maihofer and others have claimed that Marx never entertained such a hope. What Marx actually said was that 'public power loses its political character' and that the proletariat will

³¹ In both texts, according to Marx, all members of society are *workers*. As Elster pointed out, 'what Marx in his youth saw as a blind alley, he later came to see as a necessary, if transitional stage' (Elster 1985: 452).

³² See Lukes 1985: 98 ff. for an eloquent exposition of further reasons.

install an association which excludes the existence of classes and the conflict between them.³³ But consider Marx's comments (*On the Jewish Question*) on the 'perfect' state as embodiment of the universal:

The perfect political state is, by its nature, man's species-life, as opposed to his material life. All the preconditions of this egoistic life continue to exist in civil society outside the sphere of the state, but as qualities of civil society. Where the political state has attained its true development, man—not only in thought, in consciousness, but in reality, in life—leads a twofold life, a heavenly and an earthly life: life in the political community, in which he considers himself a communal being, and life in civil society, in which he acts as a private individual, regards other men as a means, degrades himself into a means, and becomes the *plaything of alien powers*. (CW iii. 153–4, my emphasis)

From this Marx concludes:

Only when the real, individual man re-absorbs in himself the abstract citizen, and as an individual human being has become a species-being in his everyday life, in his particular work, and in his particular situation, only when man has recognised and organised his '*forces propres*' as *social forces*, and consequently no longer separates social power from himself in the shape of *political power*, only then will human emancipation have been accomplished. (CW iii. 168)³⁴

It is not only that the bourgeois has to be eradicated in order to retain the life of the *citoyen*, it is rather the whole separation which Marx aims to supersede (in the sense of 'aufheben'). This follows clearly from Marx's treatment of the bourgeois state as an instance of *alienation*: 'Out of this very contradiction between particular and the common interests, the common interest assumes an independent form as the *state*, which is divorced

³³ See *Communist Manifesto* and *Poverty of Philosophy*. According to Maihofer, the formula of withering away of the state was Engels's invention. However, and ironically, Engels himself envisages a *Gemeinwesen* which organizes the association of communist society. See Maihofer 1968: 14 ff.; see also Zolo 1974.

³⁴ This is a theme which has been taken up again by the communitarian critique of liberalism. Communitarians want to fuse public and private, political and moral dimensions. Interestingly, they seem to commit the same fallacy in assimilating the 'self-rule' of society to that of an individual. However, to use Elster's words here in criticizing Marx, 'this is a scale-error of monumental size and importance', see Elster 1985: 458.

from the real individual and collective interests, and at the same time as an illusory community' (CW v. 46).

Elster convincingly argued that all debates and procedures of allocation of resources and of finding solutions to social problems are likely to assume a political character. This leads me to the second question, that is, whether Marx also overlooked the need for the maintenance of social functions such as law, economy, politics, etc. in communist society.

We have already seen that Marx claimed that the state would lose its political character in communism. This seems to entail communism eradicating the political system altogether. In so far as Marx or Marxists adhere to such a position, it must be regarded as basically unrealistic. As social research in this century has shown, there is a trend of 'autonomization of social spheres'. One could even conceive of these social autonomizations as analogous to the autonomization of the economy which Marx so brilliantly analysed. But if it is true that such an autonomization has taken place, it is improbable that it can be simply reversed. Writers like Habermas explicitly acknowledge that this social differentiation has to be interpreted as an 'evolutionary achievement', which is to say that every modern complex society must work according to the laws of different social subsystems in which money and power are the two main means of steering (see Habermas 1981: ii. 499, 501).

Marx, on the one hand, seems open to such a position when he writes in the *Critique of the Gotha Programme*: 'What social functions will remain in existence that are analogous to present state functions? This question can only be answered scientifically' (SW iii. 26). Equally open for the functional requirements of modern society (in this case of large-scale industry) was his position on education. As we saw, Marx claims that many-sided individuals will be needed by large-scale industry and that the educational system brings them forth. In the passage on child labour he even goes so far as to use the requirements of modern industry as an argument for the inevitability of child labour, which to my view is a somewhat sinister statement.³⁵ In

³⁵ He should have separated more clearly the capitalist need for child labour and his reasons for favouring a combination of theoretical and practical education. The way it stands, it could be interpreted as if Marx would not resist the squandering of children's lives in the factories.

summary, Marx acknowledges the need of modern societies to have functionally separated social spheres; sometimes he even entertains a naïve functionalist view, assuming that the requirements of large-scale industry will be fulfilled automatically.

But on the other hand he clearly favours an abolition of social systems if and in so far as they are superior powers and are experienced as fate by the individuals. Here he favours a community model over a society model. But if the modern world is characterized by such objectifications as social systems which are essential to the functioning of society (whether based on 'socialist' or 'capitalist' principles) it seems impossible to bring them back completely into the realm of intersubjective action (Habermas's 'Lebenswelt' or the communarians' 'community')—which was Marx's hope in the *Jewish Question* (*inter alia*). This would only be possible on the condition that all social functions could be performed by small local communities. However, as several authors have pointed out, any complex society needs some large-scale institutions which are organized on a regional, national, and international level and display some degree of centralization. It seems obvious, therefore, that alienation is inevitable here (and it may already exist on lower levels, from the intersubjective dimension upwards).

How could we explain this ambiguity in Marx? Lukes suggested that there might be a contradiction between the individualistic and the communitarian impulses in Marx's thought:

The notion of individuality, to which . . . Marx was so much attached . . . which reached the nineteenth century through Romanticism, Goethe supplying its artistic and Schleiermacher its metaphysical foundation—this notion prescribes that 'each individual is *called* or destined to realise his own incomparable image' (Simmel). The notion of community, to which Marx was no less attached, which is no less rooted in the Western political tradition, pictures individuals as finding their fulfilment in reciprocity and solidarity rather than competition and self-assertion, and in mutual identification in common activities and the pursuit of common purposes. (Lukes 1985: 96)³⁶

³⁶ Or, as Habermas pointed out, drawing on Schiller: 'This self-formative process is related not to the individual but to the collective life-context of the people as a whole: "Totality of character must therefore be found in a people that is capable and worthy of exchanging the State of need for the state of freedom"' (Schiller, *Sämtliche Werke*, v. 579; quoted in Habermas 1987a: 45).

This argument would explain the first ambiguity, i.e. the problem of personal conflicts. With respect to the second problem we have to look even more closely at the philosophical tradition Marx inherited. This is the task of the last section.

5.6. Technology and the limits of the philosophy of the subject

Marx follows Hegel in assuming that the subject will reappropriate its own 'creations', its own objectifications. But this assumption is dogmatic. Nothing guarantees or proves that there will be a subject or a reappropriation. For example, Seyla Benhabib rightly points out that 'Hegel's critique is based upon the normative image of a life form that has become "transparent" and intelligible to the intellect, and in which individuals once again can recognize themselves as part of a "living" as opposed to a "dead" totality' (Benhabib 1986: 30). But there is an ambivalence in Hegel's immanent critique of natural right theories which Marx was to inherit:

[O]n the one hand, he criticizes the dogmatism of modern natural right theories in reifying present social relations; on the other hand, he himself admits that there is no moment in the present upon which to anchor the view of a unified ethical life. The ideal of an ethical life is not an immanent but a transcendent ideal, in the sense that it involves looking back to the past. (ibid. 32)

Marx, like Hegel, conceives of human culture as a historical product of man's objectifications; the objects are the expression of man's inner essence and are thus prone to a 'reappropriation'. This reappropriation becomes necessary because the actual course of history has led to an alienation of man from his objects. As Benhabib puts it,

Marx's early diagnosis of the antagonism inherent in bourgeois civil society clearly parallels the Hegelian one of *Entzweiung*. The principle of essential unity is denied methodologically, but it is reasserted at the normative level as the immanent utopia which Marx claims is the implicit 'ought' towards which actuality must evolve . . . The *reappropriation* of the powers and potentialities that humanity has alienated from itself is the dream. (ibid. 38, 39)

Let me introduce a thought experiment here. If we cannot rely on a complete *Aufhebung* of alienation, we might expect a

reduction of alienation. This is to say that from the two models of communism only the weaker one is available. Recall the strong model from the beginning of this chapter. It is based on four elements: return to use-value production, reappropriation of man's objectifications, total individuals, and conscious control. These elements are four inseparable 'moments' of the Promethean image of mankind. Total individuals are individuals who have reappropriated their objectifications and have brought all their activities under their common conscious control.³⁷ This strong notion of communism clearly belongs to the notion *Bildung* of German Idealism (Humboldt, Herder) which Marx took up from Hegel's philosophy (but also from Feuerbach's materialism). As we have seen, it is contained both in Hegel's model of transformation of first nature into second nature which alone makes possible a rational character of the world and in Feuerbach's critique of religion which Marx considered the starting-point of all critique. According to him, in the emerging modern epoch, science, technology, and bourgeoisie had to fight religious tutelage and free themselves from that grip.³⁸

But, equally, the established modern epoch has to carry on the fight against every other form of 'fate' or 'alien powers'. It is thus up to the human species to acquire control over its own fate (social and natural processes) and to develop all of its species powers, as embodied in individuals.

Contrast now the weaker notion of communism:

1. abolition of private property;
2. abolition of classes, class exploitation, and class oppression;
3. universalization of happiness;
4. universalization of material wealth;
5. expanding of disposable time.

(1) and (2) are elements of standard Marxism. However, as my discussion has shown, forms of property and stratification are not the most important causes of ecological problems. I included (3) in this list since Marx thinks that people in former modes of

³⁷ The notion of *conscious control* plays a big role in the humanist tradition going back to Dante, see Girnus 1974; Klein 1974.

³⁸ Humboldt and Schleiermacher were favouring scientific autonomy which was guaranteed by the state in order to fight back religious and ecclesiastical domination. Cf. Habermas 1987b: 81.

production were happier (cf. *MEGA* II. iii. 6. 2288). But people in earlier modes of production certainly did not have full conscious control over their life-conditions: nature was an alien power, even if society was relatively transparent. Religious alienation was the normal state of these societies. I mention this only to show that (3) does not mean abolition of *alienation*. This is necessary to distinguish the weaker from the stronger notion of communism. Marx (not only in his early writings) seemed to believe that with the abolition of private property all other points would follow more or less automatically; at least the following passage from the *Paris Manuscripts* can be interpreted in such a way: 'Communism is the positive transcendence of private property, as human self-estrangement and therefore as the real appropriation of the human essence by and for man; communism therefore is the complete return of man to himself as a social (i.e. human) being—a return accomplishing consciously and embracing the entire wealth of previous development' (*CW* iii. 296; cf. *MEGA* II. iii. 6. 2144).

Let me now restate the problematic of the present work in the light of the above. Ecological problems are seen as the result of technologies operating in a highly differentiated society. The human species has developed technologies in order to dominate nature; at a certain point in their development these technologies can no longer be controlled by individuals, but only by units of social co-operation. If we recall the evolutionary models from Chapter 4, we might say that both technology and social forms have assumed a shape which escapes the control of the individuals. Both craft technology and transparent social relations (like families, guilds, towns) had dimensions which could be grasped by the individuals. Modern technologies are not at the disposal of individual craft workers; likewise, social life cannot be conceived as a family writ large.³⁹ Both stages of development display a sharp qualitative leap which any social theory has to recognize.⁴⁰

³⁹ Teubner rightly notes that some socialist and corporatist theories wrongly equate functional subsystems of societies with big corporations, capable of action (Teubner 1989a: 103). The same holds true with respect to some recent communitarian criticisms of liberalism.

⁴⁰ Adorno, in an article called 'Fortschritt', clearly sees that Hegel and Marx were aware of this autonomization of supra-individual entities. He also sees a 'mythical element' in this process: 'Innerworldly progress has its mythical

Marx pointed to both phenomena: individuals under conditions of modern industry are reduced to 'living accessories' who experience the (technical) world rather as 'fate' than as a product of their conscious control. As he said, 'in comparison with capitalist society, these old social organisms of production are far more simple and transparent' (*Capital* i. 83). Surely, science may reveal more and more secrets and solve more and more puzzles—this is also the route which Marx embarks on in order to foster his historical optimism. However, his optimism goes as far as assuming that in principle there can, and will, be a state of affairs which would make social science superfluous. In other words, Marx seems to presuppose that communism will create social relations which are entirely transparent to their members. As Cohen put it:

Marx says that relations between human beings under socialism are 'transparent' and 'intelligible'. Economic agents whose actions are integrated by a democratically formulated plan understand what they are doing . . . [Social science] has no function in a world which has abolished the discrepancy between the surface of things and their true character . . . When social science is necessary, men do not understand themselves. A society in which men do not understand themselves is a defective society. (Cohen 1978: 336–8)

This interpretation is in line with my emphasis that what counted most for Marx in the final analysis was the construction of a rational world. Cohen gives a—to my view—excellent interpretation of the eleventh thesis on Feuerbach. Marx says there: 'The philosophers have only interpreted the world, in various ways; the point is to change it.' Cohen rightly suggests interpreting this phrase not in the sense that Marx was (in contrast to Feuerbach) interested in practical questions. Rather, as Cohen suggests, we understand the meaning of the eleventh thesis best by adding 'to change it so that interpretation of it is no longer necessary' (Cohen 1978: 339, my emphasis).⁴¹ In other words: social reality must be such that it provides the conditions of intelligibility which initiate harmony between reality and

element in that it takes place over the heads of the subjects and forms them according to its likeness. Hegel and Marx understood this well' (Adorno 1977: 631–2, my trans.).

⁴¹ See the *Contribution to the Critique of Hegel's Philosophy of Law* where Marx speaks about an 'inverted world'; see *CW* iii. 175.

thought. Fetishism, which gives rise to 'false consciousness', does not mean that people are in principle unable to conceive reality. Rather, reality presents itself in the way in which it is represented by consciousness.⁴² It is up to social science to 'dissipate the mist' and provide explanations which make the world more intelligible. Contrary to Marx's hope, contemporary societies have become even more differentiated and complex. Social science is therefore needed more than ever before.

⁴² This 'realist' epistemology comes out very clearly in Marx's letter to Kugelmann of 11 July 1868: 'Since the thought process itself grows out of conditions, is itself a natural process, thinking that really comprehends must always be the same, and can vary only gradually, according to the maturity of development, including the development of the organ by which the thinking is done' (*SW* ii. 419).

Conclusion

Every interpretation and every reconstruction has to start with a reduction. It has to limit the material which it regards as relevant, it has to limit the questions it is interested in, and it has to decide which method of research to use and what style of presentation to follow. I started my research with the basic intuition that the Marxian *Wertgesetz*, his theory of value which most scholars of Marxism hold to be essential, was of no interest at all when investigating the relationship between Marxism and ecological problems. This reduction may seem quite bold and unconvincing. For was it not Marx himself who devoted much attention to an 'unfolding of the laws of motion' of capitalism? Did not he himself try to decompose the surface phenomena of capitalist society into its constitutive elements which could be described by the theory of value alone? And did not Marx then, after this decomposition, try to reconstruct the manifold phenomena of capitalist society departing from the hidden structure (*Kernstruktur*) of this very society, thereby unfolding the logic of the law of value?

True, all of these questions have to be answered in the affirmative. It is also true that Marx conceived of the law of value as the *general law* of capitalist society. Only in this type of society has the law of value found its most general expression. In pre-capitalist societies, the law of value is restricted or absent. I do not want to judge here if the law of value was effective in the way Marx thought it was during the late nineteenth century. Granted that it was, I think that two objections, one empirical and one theoretical, are fatal for it. The empirical objection is that with the emergence of the Welfare State the law of value no longer applies to society. Economic interventions, state enterprises, anti-cyclical interventions in the business cycle, and to a certain degree planning have restricted the working of the law of value in considerable ways. There has been a significant change from the 'invisible hand' to the 'visible hand' (Chandler

1977). Theoretical assumptions of the general validity of the law of value thus seem to be basically unrealistic. Perhaps a paradoxical inference makes this claim even more plausible. Socialist societies which emerged in Eastern Europe, Asia, and Cuba should have done away with the law of value—at least according to Marxist theory. Instead, these societies seemed to be plagued by the persistence of this law. Many socially undesirable features were attributed to the persistence of exactly this law. As a consequence, Marxists found themselves in the absurd situation of claiming that capitalism and socialism were characterized by the hidden working of the law of value. The law of value was thus transformed from a historical into a universal law which could only give rise to confusion and endless debates within the camp of Marxist economists (cf. Brus 1972: ch. 4 and the quoted literature). But the law of value was not of any practical help for economic planners in socialist societies. They did not (and *could not*!) take seriously the implications of this Marxist dogma since it did not indicate clear lines of action. In determining the prices for the products of socialist economies, planners usually did not count embodied quantities of labour, but tried to simulate market operations in order to arrive at equilibrium prices (cf. Brus and Laski 1989). In practical terms this came down to the question of whether socialism can be conceived as a *distinct economic system*. To affirm this usually means to consider things like state ownership in the means of production, planning, policies of full employment, etc. as distinctive of a socialist economic system. However, both recent historical events in Eastern Europe and the competent judgement of economic reformers in these countries indicate that this is rather an 'open-ended' question (ibid. 149).

The theoretical arguments which object to the theory of value were discussed immediately after the publication of the three volumes of *Das Kapital*. From the first criticisms of Böhm-Bawerk till today there seems to be enough evidence to conclude that the critics of Marx had the better arguments. This could not be admitted by any serious Marxist who saw in the existence of this law, its analysis, and propaganda by Marx and Engels at the same time the essence of capitalism and its deadly critique. The fierce defence of this central dogma of classical Marxism has its explanation in the fact that it was considered to be the corner-

stone on which the whole theoretical and practical project rested. Therefore, if the critics of Marx on this point were right, Marxism as a theory would have been refuted and Marxism as a revolutionary practice would have been defective. This was the underlying assumption on both sides.

As I said, my basic intuition was totally different. That I think Marxism has something valuable to offer in the analysis of ecological problems will surprise many of those who thought exclusively in terms of his theory of value. My other intuition was that Marxism, on a non-orthodox reading, could contribute quite a lot to the understanding of ecological problems. This is an interesting point since the social sciences until the 1980s did not seem to have much to contribute on the issue. I must say that I myself was surprised how much Marx's theory had to offer, once the strait-jacket of an orthodox interpretation was stripped off. However, one also has to point to the limits of its theoretical power.

According to Marx, every product in bourgeois society assumes the form of a commodity. A commodity embodies the unity of use-value and exchange-value. Labour also has this double character; it is the unity of concrete, use-value producing, and abstract, value-producing activity. Likewise, technology is both a means and medium to transform nature (partly constituting, partly constituted by social labour) and constant capital at the same time. My working hypothesis therefore was to explore the theoretical possibilities of abstracting from the *value* aspect in all these cases and to focus primarily on the use-value aspect. This perspective opened up a whole range of new approaches and possibilities which otherwise would have been occluded.

Marx's analysis of nature and human nature starts with quite general assumptions about transhistorical conditions in which mankind is situated. Marx coined the term *Stoffwechsel* to denote man's dependence on and his active and conscious intervention into nature. This process could, in a very abstract way, be seen as a self-mediation of nature, a process in which human beings, as parts of nature, appropriate and transform nature. However, to 'unfold' this dialectic, it is necessary to introduce other distinctions. These distinctions have to be drawn all on the side of the social, not on the side of nature. The

first distinction separates culture from nature, the second separates technology from society, and the third separates the economy from politics and both again from a religious and those again from a scientific dimension. As the reader will notice, I introduce several elements of post-Marxian sociology into a genuinely historical materialist framework. Among the former, the theories of evolution and of functional differentiation are the most important. My combination of contemporary sociological approaches with Marx's historical materialism seems to me made possible by a basic affinity between central elements of both. Note also that Marx's view of nature has some affinities with the lately promoted paradigm of constructivism in the social sciences (Berger and Luckmann 1967; Glasersfeld 1981; Watzlawick 1976). This view appears in Marx when he stresses the fact that primordial nature has been transformed by historical existing cultures into a second nature, a nature which is culturally shaped. The nature of nature, therefore, is a social construction of every single existing historical culture.

The fact that man stands at the intersection between nature and culture has further consequences. One of them is that man is at the same time a natural and a social being, he is *Natur-Mensch and Menschen-Mensch* ('Gemeinmensch, Communist') as Feuerbach put it. However, it is the human dimension which is relevant for the evaluation of the process of the appropriation and transformation of nature. In ancient societies this task was fulfilled by religious or mystical world-views. In modern times, where man has to reinvent himself/herself always anew,¹ the standards of evaluation are not eternally given but change from culture to culture, from generation to generation, from functional subsystem to functional subsystem (cf. Beck 1988; Eder 1988; Luhmann 1989b).

As I tried to show, Marx's standard for evaluation draws on a specific variant of modern thought. Most interesting are his insights deriving from his philosophical anthropology, combining results from the natural sciences with an ethical device: that human beings are to master the world and nature in such a way that they achieve adulthood (*Mündigkeit*). These two sides of

¹ As expressed by Baudelaire: 'Modernity is the transitory, the fugitive, the contingent, half of the art, the other half being the eternal and unchangeable' (Baudelaire 1954: 892, my trans.; cf. also Foucault 1984; Luhmann 1989b).

Marx's analysis are in tension with each other. Perhaps one could interpret them as corresponding to Enlightenment and Humanism, to use Foucault's distinction (see Foucault 1984: 43 f.). The critical Marxian method is expressed in a sort of categorical imperative which reads in the following way: 'The criticism of religion ends with the teaching that man is the highest being for man, hence with the categorical imperative to overthrow all relations in which man is a debased, enslaved, forsaken, despicable being.'² Human beings have to reduce or abolish domination over each other and they have to aim at a conscious control of their actions. Marx conceived of this process as being parallel to, or even the pure unfolding of, human self-realization. In putting it this way, he reconciled Enlightenment with Humanist thought.

However, further problems arise here. The reconciliation is performed in a perfectionist and romantic framework which is formulated clearly in his philosophy of history. Inherent in history's course was a *telos* which had to be realized. For Marx, like Hegel, this *telos* was the reconciliation of the fragmented parts of modernity, the abolition of all deep-seated oppositions which characterize modern bourgeois society. To be sure, Marx diverges from Hegel in that he replaces the function which spirit occupies in Hegel's system with the function of *productive labour*. Nevertheless, he inherits all the problems of Hegel's philosophy of identity. For communism is seen as a state of affairs in which mankind is in harmony with its own creations, in which it has solved the riddle of history and knows itself as its solution, as he put it in the *Paris Manuscripts*. This teleology has been submitted to sharp criticism, and rightly so. I mention only the works of Kolakowski, Charles Taylor, and Habermas. (As an aside, for Marx this communist future will not mark an end of history, but an end to pre-history, for it is only now that people have come to produce their life-conditions consciously that they can make history properly.)

Marx did not directly address the problem he was facing. This problem was: how can the individual need for self-realization be reconciled with the development of productive forces which are, after all, a *social* entity? Does every productive force have to

² *Contribution to the Critique of Hegel's Philosophy of Law*, CW iii. 182.

be within the scope of single individuals, every time controllable by them? How does Marx relate the individual to the social? The answer is that he tries to avoid this problem altogether by synthesizing Feuerbach's *Gattungswesen* with historical empirical development. This theoretical move is expressed in the turn from the *Paris Manuscripts* to the *German Ideology*. Marx thinks that human objectifications are the embodiment and examples of human self-realization, to put it crudely: the *Gattungswesen* in palpable form. This move was supposed to give him a firm stance against philosophical speculation. In fact, it opened the way to historical materialism. However, Marx never abandoned the expressivist conception of *Gattungswesen* which, at later stages of theoretical development, returns. Every time Marx confronts this return, he remembers his commitment to *Gattungswesen* and advances solutions which abolish deep-seated oppositions in society, and which favour the individual. To be sure, Marx rarely addressed this problem in the terms I am using here. For him, all deep-seated oppositions were crystallizing in class cleavages. Therefore it was sufficient to abolish class rule in order to liberate human potentials. But in addressing the problem of technology, he faced the problem again and again. He became aware that a single change in property forms and the abolition of classes might not be sufficient to turn existing productive forces into authentic examples of human self-development. However, as I tried to show, Marx concealed this disquieting issue.

Now, one might argue: granted there is a critical potential in Marxism with respect to ecological problems, but it has been achieved at too great a cost, that is, only by subscribing to the philosophy of identity, which is untenable. The answer would be that we can separate in Marx the assumptions of Hegel's identity philosophy from his critical method. In other words: we should use Kant's critical method³ and not Hegel's identity philosophy as the major reference point. Thereby, I think, one would get a sort of general⁴ standard for criticism which does not commit itself to the strong assumptions made in Marx's theory of history (cf. Foucault 1984). This critical model would

³ For some early studies on the relationship between Kant and Marx, see Vorländer 1900; Bauer 1905; Adler 1975. For a recent attempt, see Kain 1988.

⁴ Not universal, for it is based on purely modern conditions!

also be different both from neo-Kantian positions such as Habermas's discourse ethics (which, as is known, relies on linguistic reasoning) and from Anglo-American liberalism such as Rawls's theory. That it has something of interest to offer, I shall try to explain now, coming back to the question of ecology.

The process of transforming nature entails the danger that it does not work to the benefit of the producers. One reason for this may be that the whole process of transforming nature has grown 'out of control', that people are, as before, ruled by a 'blind fate'. It would follow that people have to achieve their power to control their life and thereby achieve human dignity. But this perspective can only be understood in a weak sense, not in the sense that there will be an end-state which has realized all of these ideals. Modern societies are characterized by a social and technological dynamism which makes an eventual 'halting point', at which mankind and nature are in balance, quite implausible. The proposed critical model is therefore not to be understood as containing the programme for a reconciled society; it only contains a critical potential which can be applied in different circumstances in order to improve the predicament of mankind.

This approach differs from Rawls's or Habermas's in the following way. Rawls is operating on a much more modest level. The scope of his criticism lies exclusively on the level of justice; problems of the above-mentioned kind fall outside his point of view. In this sense, Marx's preference for human freedom (over justice and *Recht*) has something to it. I do not doubt that Rawls's procedural techniques have much to offer regarding the process of finding a just regulation of, say, scarcity of resources, or distribution of wealth, but his theory gets these problems into its view only when they have already occurred.

Habermas, in a similar way to Rawls, excludes from his analysis the locus where ecological problems are produced. His reaction to the alleged weakness of the praxis-philosophical reading of Marx is an overreaction and blinds him to the potential which really is implicit in this reading when properly understood. This leaves Habermas with the only critical tool for investigating discursive activities which would establish the conditions for an unconstrained consensus. For Habermas, the emancipatory potential lies completely within the communicative type of

action. Strategic-instrumental action, on the other hand, which is outcome-orientated and applies to processes of transforming nature, does not contain any critical standards. But note: it is only after having read Marx and the praxis-philosophers with these spectacles that Habermas can derive a reduced account of the concept of labour which is bare of any emancipatory potential.

Now I return to the proposed combination of historical materialism and systems theory which I carried out in a framework of coevolution. It may be noted that 'social forms' here means something slightly different from in Marx's framework. According to Marx's definition there are three major social forms which history has so far developed: ancient, feudal, and capitalist. To every historical epoch (= social form) Marx attributes a specific technology and specific forms of social co-operation (see Fig. 4.3). Marx himself pulls these elements together in a model in which different layers are in a relation of determination. At times Marx thinks that the development of the productive forces is the deepest layer in all societies and that this layer constantly develops and causes the relations of production (the social forms) to change accordingly. However, as I have shown, both empirical evidence and Marx's own considerations make clear that the development of productive forces is also influenced by the specific relations of production. To get a clearer picture, I therefore proposed to replace this somewhat obscure terminology of relations of production and productive forces with a conceptual framework which was developed by post-Marxian sociology, that is, the language of functional differentiation as we find it in Durkheim, Weber, Simmel, Parsons, Luhmann, and others.

Replacing the too general 'social relations of production' with more accurate and sharper conceptual tools allows us to get better insights into the complicated process of technological and social coevolution. Economy, science, and politics are the most important social spheres which contribute to the development of productive forces and are, in turn, themselves conditioned by a historical level of technology and its potentials. In using additionally a systems theoretical model for the reformulation of historical materialism, I hope to clarify further the real possibilities and dangers of such a coevolutionary process. Productive forces are no autonomous force in history, they are

socially shaped. It thus seems that a contemporary fear of a technologically inevitable trajectory which leads to an increasing domination over people and to more or deeper ecological problems is not sufficiently founded. But the opposite is not true either. Since modern societies do not possess a centre, the planning of society and technology becomes difficult if not impossible. Furthermore, all social systems are operating on the basis of their own logic or code—each code being different from the others. The result is that each social system is a closed universe for the others, and none of them has primacy over the others. Autopoietic systems theory has not yet developed a convincing solution to the problem of how intersystemic communication can be conceived—a theoretical requirement for the understanding of such a process. I have suggested some possible steps to handle the problem (ss. 3.3 and 4.3) which I do not repeat here.

It is well known that communist parties in Eastern Europe claimed to be the sole organizations equipped to discover the objective laws of nature. A society that is consciously administered does not experience the same contradictions as capitalist societies (cf. Ziegler 1987: 35). However, functional differentiation has eroded the party's privileged position as it has generally eroded any privileged position. The problems of regulatory politics are thus not very different in East and West. Most industrially advanced societies face severe ecological problems which are the result of their highly developed processes of transforming nature. Part of these societies are social movements and political forces which expose these problems and make them into political issues. Such issues became more and more important in the late 1980s.

The emergence of ecological parties in the West has led to a considerable legitimization crisis of governments in power. As a result, many political parties all over the world have taken up ecological issues. Politicians, therefore, try to decrease ecological problems where possible. However, they are restricted when doing so. Politics does not stand at the top of a (pyramidal) society nor in the centre of a (concentric) society: it is one social subsystem among others. This is to say that politics cannot be expected to cure modern societies of the disease of ecological problems. What politics does is to decide on public issues in a

binding way.⁵ These decisions may also have effects on the economy or on science, but not in a direct way. We know of many cases where such attempts have proved to be dysfunctional for the solution of a problem. But there are also examples of successful political interventions (see Rottleuthner 1989; Scharpf 1989; Bühl 1989).

My claim that politics is not able to abolish ecological problems need not be confused with a statement which would affirm that nothing can be done. As I have indicated, the process of technological development is crucial here. It would be naïve to believe that politics could bring about new, less harmful technologies just by ordering them. Technologies which are economizing resources, which are less polluting, and which are safer (in the sense that they do not lead necessarily to industrial accidents) can only be the result of a social process in which scientific, political, and economic forces are the most important. The fact that politics is only one force in this process indicates that it cannot plan it from the outside, but the corollary is that politics, because it is part of that process, may be able to influence it from inside.

It may be objected to my systems theoretical reformulation of historical materialism that this is a contradiction in terms since Marx's ethical theory and the cool functional analyses of systems theory are incommensurable. In a certain sense this objection repeats the long-standing schism between Marxism as humanism v. Marxism as anti-humanism. In claiming that both sides are reconcilable I also have to show in what sense the debate within Marxism was misconceived. In fact, I think that it revolved around a false dichotomy. The argument which is supposed to sustain my claim is that Marx's analysis of alienation and fetishism has to be detached from the individual level and that there is an equivalent for 'alienation' in systems theory. This is to say that the abolition or reduction of alienation not only, and not in the first place, means the change of certain psychic states of modern men, or enabling them *as individuals* to control

⁵ Where ecological problems are the result of a logic of public goods, politics seems to have some power to resolve them. Examples are cases where ecological problems are manifest and where it is possible to neutralize them by a combined policy of (legal) threats and (economic) offers. See Steiner 1974; Taylor 1982; Teubner 1987.

social life, but, more importantly, means the enabling of social systems to get control over their environment. This 'getting control' is a shorthand to describe the complex feedback loop from society, including human needs and interests, affecting nature by means of technology, to nature which finally makes itself felt to society.

At the turn of the twenty-first century one must acknowledge that Marx's hope of reconciling the individual with society is in vain. The conditions of a society in which the free development of each is the condition for the free development of all, and in which complete transparency is achieved, do not obtain. In so far as Marx's argument of a withering away of justice (and the state) was based on the assumption that communism would overcome scarcity, it was refuted by the occurrence of ecological problems like scarcity of resources and pollution. Additionally, the mechanism of positional goods (Hirsch 1977) thwarts the possibility of a justice-free society. In so far as Marx's argument was based on the assumption that communism would bring about social transparency, this was refuted by an increase in functional differentiation. In other words, the basic separation of politics and economy was not only not reversed (as Marx expected), but completed and aggravated by additional differences.

Precisely here lies the great virtue of systems theory for the reconstruction of historical materialism. The big problem in modern societies is not that individuals do not understand the working of certain technologies or of social systems. This does happen and has well-known effects, but these should be minimized. Far more serious is the problem that social systems are often unable to observe and control (to 'understand') the effects of their own working on themselves. I suggest using the concept of alienation on this level also. The basic meaning remains the same; what is changed is the point of reference. It switches from the individual to the social. What Luhmann calls 'Rationalität' (1984a: 638 ff.) of social systems would in my reading be a state of affairs in which no alienation thus understood exists.

In making Marx's humanism compatible with systems theory one has to pay a price. In my view, the price should be to drop the reference point of a subject which gets alienated and to replace it with the notion of social systems. To be sure, there is (at least) another possibility of reconciling the two. It is possible to

criticize capitalism exactly in terms of *individual* alienation, that is, to denounce every step in social differentiation as a further instance of the scandalous performance of capitalism. This is the solution favoured by many contemporary thinkers, whether Marxists, ex-Marxists, greens, or communitarians. For example, the influential model of 'small is beautiful' recommends the re-dimensioning of social and technical reality. I do not doubt that one can make such criticism with good reason and also with the help of Marx's notion of alienation. But neither do I think that it is congenial to Marx's general line of thought nor does it correspond to present social reality and its possibilities. The historical drive towards functional differentiation has been so strong that it could not be opposed by such simple models of social life which all, in a way, take as their reference point the community and autarchy of the Greek polis. To advance such a type of argument in a society which exists on a world scale and which is highly mobile, pluralistic, loosening traditional bonds, resembles the attitude of Don Quixote who 'long ago paid the penalty for wrongly imagining that knight errantry was compatible with all economic forms of society' (*Capital* i. 86 n.). Marx tried to find out real possibilities of social change on the basis of an analysis of the obtaining historical conditions. The direction of social change was indicated by his philosophical anthropology and the philosophy of identity. The real possibility for him was embodied in the working class which could bring about a new organization of society. However, this specific version of historical materialism is less and less convincing. Yet any project of human self-realization and of the overcoming of alienation has to be founded on a sound analysis of social reality, if it is not to become a pious wish.

Heidegger made the intriguing statement that in the modern epoch man becomes the centre and measure of all beings (cf. Habermas 1987a: 133).⁶ This phrase can be taken at face value, that is, as a statement about the modern condition. But it can also be understood in a critical way, that is, that man *should* be measure and middle of all beings. In Heidegger, both meanings are intertwined. He continues his statement: 'Man is the *sub-jectum*, that which lies at the bottom of all beings, that is, in

⁶ 'Das Zeitalter, das wir die Neuzeit nennen, bestimmt sich dadurch, daß der Mensch Maß und Mitte des Seienden wird' (Heidegger 1961: ii. 61).

modern terms, at the bottom of all objectification and representation.⁷ The term 'objectification' (*Vergegenständlichung*) points to the former, the term 'representation' (or: 'imagination', *Vorstellbarkeit*) to the critical dimension. Marx is different. For him, the loss of individual power over social relations was a fact of reality; for him it was all about reinvesting the individual with its lost power. The model was a society conceived as community on a world scale in which there were plenty of resources and goods and hence no need for justice. Likewise, the distinction between politics and economy, and between *citoyen* and *bourgeois*, would be overcome. The individual would reappropriate all externalized forces as *forces propres*.

In so far as critics of modern society base their panacea on this outline, they are likely to imitate Don Quixote. They take over from Marx a model of society (de-differentiation) without reconsidering its analytical and historical foundations. But if the preconditions on which Marx based this critical model are no longer valid, the critical model itself loses its power. Social theory, especially the theory of functional differentiation, has evidenced the changing features of modern society. Sophisticated critical writers like Jürgen Habermas and others have acknowledged this fact. The critical outline, therefore, has to take another form than the Marxian.⁸

Marx and Engels thought that they had developed socialism from an Utopian notion into a science. They did not foresee that their model of social science was to become one among many others and that its practical message would lose its plausibility. Moreover, as 'Marxism as a science' ran into all kinds of difficulties, it took little to proclaim the counter-reaction to the Marx-Engels slogan. Marxism was now faulted for having gone too far in the direction of science. What was needed was the Utopian element.⁹ I distinguished between Marxism as a science and Marxism as a critique (see ch. 2) and I maintained that the

⁷ 'Der Mensch ist das allem Seienden, d.h. neuzeitlich aller *Vergegenständlichung* und *Vorstellbarkeit* zugrundeliegende, das subjectum' (quoted in Habermas 1985: 160, emphasis added).

⁸ For an example of criticizing Habermas for going too far in the direction of systems theory and functionalism, see McCarthy 1985. In effect, many left-wing authors think that Habermas is compromising with the devil.

⁹ Cf. Ernst Bloch's notion of a cold and a warm stream within Marxism, Hudson 1982. See also Wallerstein 1986; Ricoeur 1986.

former was blind to certain problems which have to do with motivational forces of social change whereas the latter draws upon a Utopian dimension. As Ricoeur (1986) aptly pointed out, Utopia has an important function for society. It is a sort of store of historically transmitted images and fantasies which helps us to imagine other possible worlds. Ricoeur thus re-evaluates the notion of Utopia (which is often used in a pejorative sense among social scientists and philosophers) in assigning to it an essentially positive role. He even goes so far as to affirm that a society without Utopia is a dead society. In the present context it is important to note that critical social theory has to achieve something more than just proclaiming Utopian ideas. It has to give a thorough analysis of the historical conditions which are under discussion and then to test some of the tools from Utopia's store. If this dialectic is forgotten, the process of criticism degenerates into an end in itself. The fact that modern society is not constructed according to human size and logic does not mean that we have to forget about such ideals. The question to which this book has tried to contribute, therefore, is: how can we strive towards them on the basis of a sound analysis, without simply invoking a 'paradise lost'?

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